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PROTOTYPE TRAINER

Requirements Analysis Report

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EER SYSTEMS

N-v-M
PROTOTYPE TRAINER

Requirements Analysis Report

March 12, 1989

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TABLE OF CONTENTS

SECTION	TITLE	PAGE
I	INTRODUCTION	1
	OBJECTIVES	1
	BACKGROUND	1
	THE PROBLEM	2
II	SYSTEM DESCRIPTION	3
	THROTTLE CONTROLS	3
	FLIGHT CONTROL STICK CONTROLS	6
III	TECHNICAL APPROACH	8
	OVERVIEW	8
	DEVELOP TASK LISTING	8
	IDENTIFY TRAINER REQUIREMENTS	9
	PREPARE HOTAS TRAINER FUNCTIONAL SPECIFICATION	11
IV	FINDINGS	12
V	CONCLUSIONS	16
	GENERAL	16
	AIR-TO-AIR OPERATIONS	19
	AIR-TO-GROUND OPERATIONS	19
	DEFENSIVE OPERATIONS	19
VI	RECOMMENDATIONS	21
BIBLIOGRAPHY		22
ACRONYMS		25
APPENDIX A:	HOTAS TASK QUESTIONNAIRE	A-1
APPENDIX B:	QUESTIONNAIRE DATA SUMMARY	B-1
APPENDIX C:	TRAINER TASK DESCRIPTION MATRIX	C-1

SECTION I

INTRODUCTION

1. OBJECTIVES

The objectives of this analysis are to: (a) identify the critical pilot HOTAS tasks and skills which need to be improved and/or maintained when deployed, (b) define the training requirements for the device that will meet the needs of the fleet, and (c) develop a preliminary specification that functionally defines the trainer and its capabilities.

2. BACKGROUND

The F/A-18 aircraft was designed with a Hands on Throttle and Stick (HOTAS) system to allow the pilot to control a wide variety of weapons, sensors and displays during critical mission phases while still maintaining flight control of the aircraft. In other words, the HOTAS concept enables the pilot to keep his hands on the power and flight controls and still perform his mission operations effectively.

The HOTAS system consists of seven controls on the flight control stick and nine controls on the throttles. These controls can be used in an almost infinite variety of combinations depending on the mode of operation in which the aircraft is configured, i.e. Navigation, Air-to-Air or Air-to-Ground. The manipulation of the HOTAS controls provides a vast array of information to the pilot on the left and right Digital Display Indicators (DDI), Horizontal Indicator (HI) and Head Up Display (HUD). Based on the pilot's interpretation of this displayed information, offensive weapon delivery and defensive electronic countermeasures (ECM) are then taken by further manipulation of the HOTAS controls.

To achieve the high level of pilot skill necessary to use the HOTAS system efficiently, extensive training and practice is required. Initial training in the operational use of the HOTAS is accomplished at the Fleet Readiness Squadron (FRS) in land based training devices such as the 15C13 HOTAS Part Task Trainer (PTT), the 2F132 F/A-18 Operational Flight Trainer (OFT), and the 2E7 Weapons Tactics Trainer (WTT). Once the pilot graduates from the FRS and is assigned to an operational squadron, he must maintain his HOTAS skills through operational

flights and, whenever possible, through the use of trainers located at centralized state-side bases. Once the pilot's squadron deploys to a remote location, however, the means to practice many of the most critical HOTAS skills are no longer available.

3. THE PROBLEM

The non-availability of means to maintain, and perhaps improve HOTAS skills as discussed above, has established a valid need for a deployable, shipboard trainer that can provide continuing HOTAS training during remote operational assignments. As can be seen in the preceding paragraphs, the HOTAS system requires complex perceptual, psychomotor, information processing, and decision making skills to enable the F/A-18 pilot to perform his mission effectively in an operational environment. These skills can only be maintained and improved with practice on a continuing basis.

The problem at issue in this study is to define a deployable HOTAS trainer that will meet HOTAS system training requirements and constraints in a manner that is educationally sound and in a configuration that is acceptable to the fleet. Inherent in a shipboard, deployable trainer are all the built-in constraints associated with mobility, lack of space, harsh operating environment, and limited maintenance and logistics support. Other requirements cited in the Statement of Work (SOW) are that the trainer will be used without an instructor and must, therefore, have the capability to allow the user to set conditions and initialize his practice mission, measure his performance and then provide him feedback on his performance. These constraints and requirements indicate the need for an extremely sophisticated, highly automated training device.

SECTION II

SYSTEM DESCRIPTION

The F/A-18 has three master modes of operation: Navigation (NAV), Air-to-Air (A/A), and Air-to-Ground A/G. The HOTAS controls (see Figure 1) are an integral part of the successful operation of the aircraft in any of the master modes in effect during the accomplishment of a mission. The HOTAS controls consist of 16 switches; seven on the flight control stick and nine on the throttle. Many of the switches have different functions depending on the master mode in effect at any given time. A brief description of the HOTAS controls follows.

1. THROTTLE CONTROLS

   a. Communications Switch - Three position rocker switch. Initiates transmissions on Channels 1 or 2.

   b. Flare/Chaff Dispenser Switch - Three position momentary switch. Releases chaff or flares.

   c. Cage/Uncage Switch - Momentary pushbutton switch. In the A/A master mode, it cages or uncages the Sidewinder missile and gun sight reticle as follows:

      (1) Sidewinder Missile Mode:

      First activation - Cage setting commands the Sidewinder (AIM-9) seeker head to align itself to the aircraft boresight axis.

      Second Activation - Uncage setting commands the Sidewinder seeker head to align itself with the scanning pattern of the radar line of sight.

      (2) Gun Mode:

      First Activation - Changes fixed range of 2,000 feet to 1,000, feet with a 25 milliradian diameter stadiometric reticle displayed on the HUD.

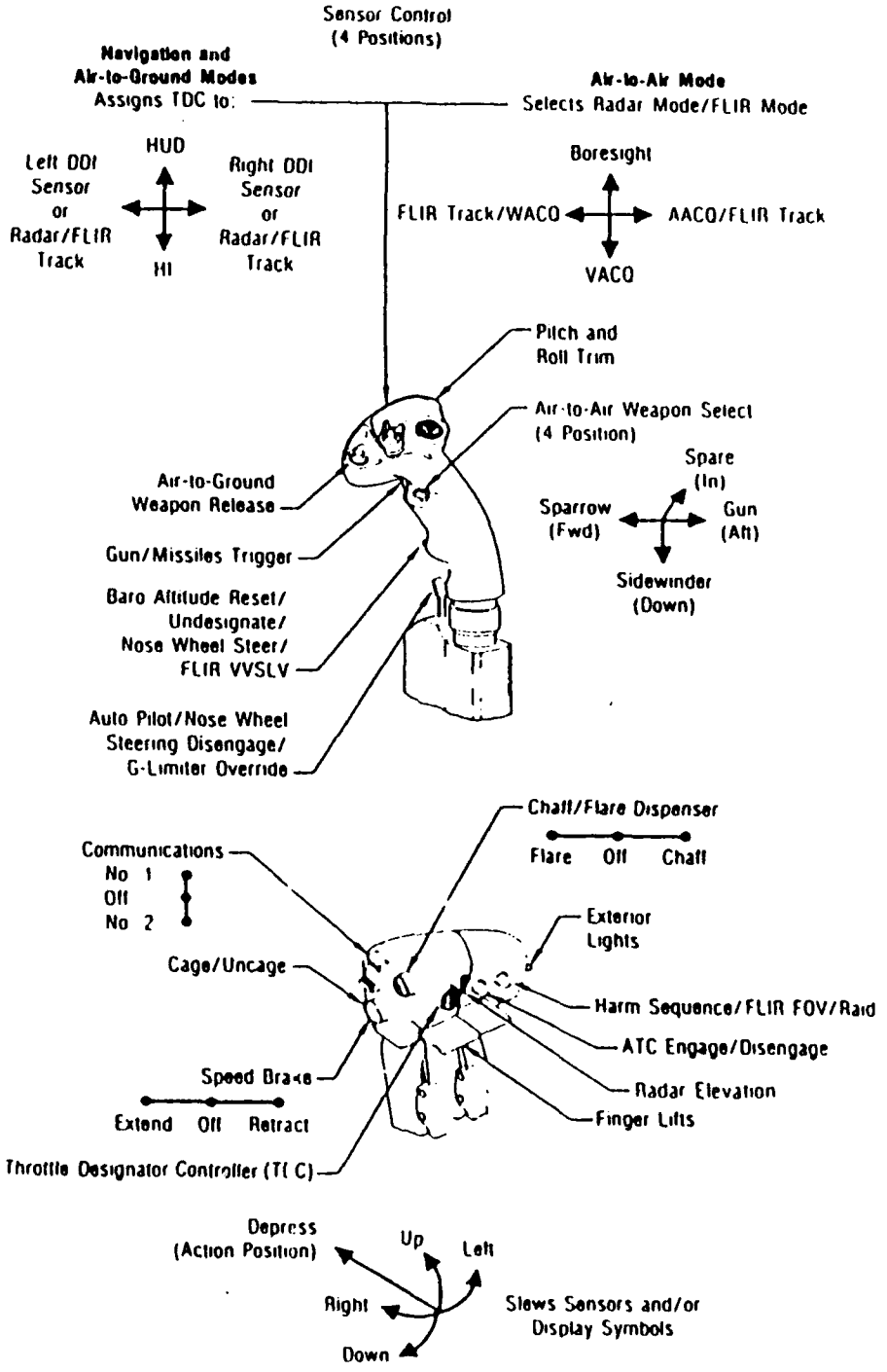

FIGURE 1 - Flight Control Stick and Throttle Switches

Second Activation - Changes range back to a fixed setting of 2,000 feet with a 12.5 milliradian diameter stadiometric reticle displayed on the HUD.

In the A/G master mode, the Cage/Uncage switch performs essentially the same functions for the Maverick and Walleye missiles and the gun as it does in the A/A mode for the AIM-9 and the gun. When in the HARM Target of Opportunity (TOO) mode, depressing the switch hands off target data to the HARM selected for firing. With a SHRIKE missile aboard, switch activation commands angle gate enable/disable. (Angle gate enable reduces the radar acquisition window but increases reflectivity in order to better discriminate among and select targets.) Finally, in the NAV master mode, the velocity vector symbol on the HUD may be caged by activation of the switch in which case flight path/pitch ladder and steering information will be displayed near the center of the HUD.

d. Speed Brake Switch - Three position slide switch. Extends or retracts the speed brake:

Extend (aft position) - Extends speed brake.

Off (center position) - Inactivates speed brake.

Retract (forward position) - retracts speed brake.

e. Throttle Designator Control (TDC) - Four way force transducer with push button switch. Provides x and y outputs for the display cursor and/or sensor control. The push button is used for target designation and sensor control functions.

f. Automatic Throttle Control (ATC) Switch - Momentary pushbutton switch interfaced with the Flight Control System (FCS). Alternate depressions of the switch engage or disengage the automatic throttle control. When the ATC is engaged while in the landing configuration, the FCS adjusts power to maintain constant AOA. When the ATC is engaged while not in the landing configuration, the FCS adjusts power to maintain constant true air speed.

g. HARM Sequence/FLIR FOV/Raid Switch - Momentary pushbutton switch interfaced with the Stores Management Set. Operation is as follows:

(1) HARM Sequence - In all master modes, when HARM is in the Self-Protect Pullback and A/G modes, and when HARM is in the TOO or Self Protect mode, depressing and releasing the pushbotton sequences through available targets. In the Self Protect mode, the sequence is from the highest to the lowest priority target. In the A/G and NAV modes, with HARM in the TOO monitor mode (HARM not the selected weapon), the TDC must be assigned to the HARM format for the HARM sequence to operate.

(2) FLIR FOV - In the A/G and NAV modes, when the FLIR is in operation and the switch is not dedicated to HARM, depressing and releasing the button toggles the field of view (FOV) between wide and narrow.

(3) RAID - In the A/A mode (and in the NAV mode when the TDC is assigned to the A/A radar) with the radar operating in Single Target Track (STT), or Track While Scan (TWS), and HARM is not in Self Protect Pullback, depressing and releasing the pushbutton commands the radar from STT or TWS to the RAID mode. Depressing and releasing it again commands the radar to STT.

h. Exterior Light Switch - Two position switch. Turns exterior lights on and off

i. Radar Elevation Switch - Potentiometer. Raises and lowers radar antenna's spatial coverage.

2. FLIGHT CONTROL STICK CONTROLS

a. A/G Weapon Release Switch - Momentary pushbutton switch. Commands weapon release and, if the Video Tape Recording System (VTRS) is on board and activated via the Camera Video Tape Panel controls, the HUD imagery or raster video from the left or right DDI and the headset audio will be recorded.

b. A/A Weapon Release Switch - Four position toggle and pushbutton switch. Selects A/A weapons (Sparrow, Sidewinder or gun) and places the Weapon System in the A/A master mode.

c. Gun/Missile Trigger Switch - Two detent switch. Fires gun and Sparrow and Sidewinder missiles.

d. Sensor Control Switch - Four position momentary switch. Function depends on which of its two modes of operation (NAV-A/G and A/A) are in effect. Functions include assigning TDC priority to sensors and weapons; assigning the TDC to the HUD and the HI; placing the radar in various modes of operation; and commanding FLIR to track or break track.

e. Trim Switch - Four position momentary switch. Adjusts aircraft pitch and roll trim.

f. Undesignate/Nose Wheel Steering Switch - Momentary pushbutton switch. Undesignates all designated targets; commands radar and FLIR to break lock if tracking targets; changes radar modes; and engages nose wheel steering in weight-on-wheels condition.

g. Autopilot/NWS Disengage Switch - Momentary paddle switch. In weight-on-wheels state (aircraft on the ground), it disengages the autopilot or overrides G-limiter. In weight-off-wheels condition (aircraft in flight), it disengages nose wheel steering.

SECTION III

TECHNICAL APPROACH

1. OVERVIEW

This report summarizes the results of two of the three major tasks involved in developing a functional specification for a deployable HOTAS trainer. A brief outline of project tasks is as follows:

I. Develop task listing

- A. Collect and Review HOTAS Documentation
- B. Develop Trainer Task Listing
- C. Prepare Task Listing Report

II. Identify trainer requirements

- A. Administer HOTAS Questionnaire
- B. Develop Trainer Task Description Matrix
- C. Identify Trainer Requirements
- D. Prepare Requirements Analysis Report

III. Prepare Deployable HOTAS Trainer Functional Specification

This report marks the completion of the second phase of the analysis. The remainder of the effort will be devoted to the preparation of the Functional Specification. A more detailed discussion of the tasks accomplished thus far is presented below.

2. DEVELOP TASK LISTING

a. Collect and Review HOTAS Documentation

In order to identify and define the requirements for the deployable HOTAS trainer, as many appropriate F/A-18 documents as possible were collected for review. Included were NATOPS and flight manuals, military characteristics reports and engineering specifications for similar, existing devices, and various HOTAS study and MCAIR system reports. A complete list of the documents reviewed can be found in the bibliography located at the end of this report.

The available F/A-18 HOTAS data was reviewed to identify the functions performed by the HOTAS controls and their relationship with the cockpit displays. It was found that the controls perform a multiplicity of functions and that the functions vary depending on which master mode (A/A, A/G, NAV) is in operation. This data was analyzed and used as the basis for developing the task listing and trainer requirements data.

b. Develop Trainer Task Listing

Although many of the documents discussed above provided usable information for the development of the trainer task listing, the primary resource for this task was the current issue of the "Objectives Hierarchy Report" developed for the F/A-18 Instructional System Development program being used at the three F/A-18 training squadrons. Since the HOTAS System was the object of the analysis, the effort was limited to identifying only those tasks associated with the three primary phases of a tactical mission i.e. air-to-air, air-to-ground, and tactical defense; routine flight and housekeeping operations were not considered.

An overall listing of all HOTAS tasks performed in the three master modes was compiled. This task listing represents an overall description of the pilot's job on a tactical mission. Based on the documentation available and preliminary analysis of data from a questionnaire administered to fleet personnel, (see below), those tasks with a comparative low priority were identified for possible future elimination from further consideration as tasks for training on a deployable HOTAS trainer.

c. Prepare Task Listing Report

The task listing discussed above was integrated into a formal report which was submitted as a deliverable to NTSC.

3. IDENTIFY TRAINER REQUIREMENTS

a. Administer HOTAS Questionnaire

The basic approach taken to determine the capabilities and functions that should be incorporated into the HOTAS deployable trainer was to survey the potential fleet users of the device in order to obtain their expert judgments. The objective of thesurvey was to determine what features should be included in the trainer to enable fleet personnel to maintain their HOTAS skills while deployed. A questionnaire was developed through a combined effort by NTSC and EER Systems, which concentrated on the complexity,

difficulty, criticality, and frequency of pilot tasks requiring the use of the seven control stick and nine throttle switches of the HOTAS while under the various master modes of tactical operation. A draft of the questionnaire was sent to the F/A-18 Fleet Project Team (FPT) for review and comment. Following receipt of FPT comments, the questionnaire was modified to accommodate FPT recommendations and prepared for administration. A copy of the questionnaire is presented in Appendix A.

The questionnaire was administered at two locations: NAS Lemoore and NAS Cecil Field. Unforeseen circumstances at NAS Lemoore resulted in an extremely small sample of only four pilots to fill out the questionnaire. Following completion of the questionnaires, an informal discussion was held with the pilots to pick up any additional requirements that might be appropriate. The same procedure was followed at Cecil Field where an additional 16 questionnaires were completed for a total of 20. While this was not as large a sample population as was desired, the consistency of responses was sufficiently high to indicate valid data. A summary of response data can be found in Appendix B.

b. Develop a Trainer Task Description Matrix

The Trainer Task Description Matrix was developed to provide additional information for the identification of the training capabilities requirements for the HOTAS Deployable Trainer. The approach used in the development of the matrix was to take the task listing previously completed, add a number of subtasks gleaned from documentation not available previously, and assign to each task/subtask, the conditions under which it would be performed. The cockpit controls, displays and indicators required to accomplish each task were then identified and added to the matrix as were the simulation requirements for each task or group of tasks. The final item in the matrix is a level of priority (three tier) for incorporating the simulation requirements into the trainer. The priorities were assigned on the basis of the information found in the reference documentation, and in the questionnaire and interview data obtained from the F/A-18 pilots. The Trainer Task Description Matrix, together with the HOTAS Task Questionnaire data, will provide the basic data for preparation of the HOTAS Deployable Trainer Preliminary Functional Specification. The Trainer Task Description Matrix is presented in Appendix C

c. Identify HOTAS Trainer Requirements

The responses to the questionnaires were combined into simple means, totals and percentages and summarized as presented in Appendix B. This summary data was analyzed and integrated with the information resulting from the informal discussions held with F/A-18 pilots and with the data tabulated on the Trainer Task Description Matrix. This analysis resulted in a set of prioritized requirements for the functions, controls and displays that should be incorporated into a deployable HOTAS trainer. They will provide the basis for developing the final deliverable of this project i.e. the functional specification for the deployable HOTAS trainer. The requirements are cited in the Recommendations and Conclusions section of this report.

d. Prepare the Requirements Analysis Report

This task was directed to the preparation of this Requirements Analysis Report which is submitted as a contract deliverable.

4. PREPARE DEPLOYABLE HOTAS TRAINER FUNCTIONAL SPECIFICATION

This effort will be the final deliverable of CDRL Item A003 of the N-v-M contract. When completed, it will provide a functional description of a deployable HOTAS trainer in sufficient detail to enable engineering personnel to use it as the basis for developing a detailed engineering specification for the device. As stated above, the functional description will be based on the requirements data developed during the earlier phases of this task.

SECTION IV

FINDINGS

This section presents the findings that resulted from the administration of the HOTAS Task Questionnaire shown in Appendix A. These findings are based on the responses of the pilots who completed the questionnaire as summarized in the data shown in Appendix B, Parts II and III. All responses are listed in rank order according to the responses. The percentages cited reflect the number of pilots responding to a specific item versus the total number of pilots surveyed.

1. Of the three Master Modes, the Air-to-Air Mode is considered the most difficult (53%) and complex (65%) to operate. The Air-to-Ground Mode is considered somewhat less difficult (42%) and complex (35%) while the Navigation Mode is considered neither difficult (5%) nor complex (0%) to operate. (Questions 1 and 2)

2. The HOTAS controls which are considered the most important (Question 3):

Throttle		Control Stick	
Throttle Designator Cont.	90%	A/A Weapon Select Switch	70%
Radar Elevation Switch	30%	Sensor Control Switch	50&
HARM Seq./FLIR FOV/Raid Sw.	20%	Gun/Missiles Trigger	40%
Chaff/Flare Dispenser Sw.	20%	A/G Weapon Release Sw.	25%

3. The HOTAS controls which require the most practice to maintain proficiency (Question 4):

Throttle		Control Stick	
Throttle Designator Cont.	90%	Sensor Control Switch	70%
Radar Elevation Switch	65%	A/A Weapon Select Switch	50%
Chaff/Flare Dispenser Sw.	45%		
HARM Seq./FLIR FOV/Raid Sw.	30%		
Cage/Uncage Switch	25%		

4. The HOTAS controls which are the most difficult to set up correctly (Question 5)

AIR-TO-AIR MODE

Throttle		Control Switch	
Throttle Designator Cont.	72%	Sensor Control Switch	39%
Radar Elevation Switch	55%	A/A Weapon Select Sw.	22%
Chaff/Flare Dispenser Sw.	33%	Gun/Missile Switch	11%
HARM Seq./FLIR FOV/Raid Sw.	17%		
Cage/Uncage Switch	22%		

AIR-TO-GROUND MODE

Throttle		Control Stick	
HARM Seq./FLIR FOV/Raid Sw.	67%	Sensor Control Switch	39%
Throttle Designator Cont.	61%	A/G Weap. Rel. Switch	17%
Chaff/Flare Dispenser Sw.	28%	Gun/Missile Trigger	5%
Radar Elevation Switch	17%		
Cage/Uncage Switch	11%		

5. The responses to questions 6 through 12 of the questionnaire were consistent with the responses shown above and provided reinforcement to their validity. A breakdown of specific response data for these items can be found in Appendix B.

6. In an EW environment, the Chaff/Flare Dispenser Switch is considered the most critical control and the Radar Warning Receiver (RWR/ALR-67) with the HUD are considered the most critical displays (Question 13). Complete data for these and less critical controls and displays is shown in Appendix B.

7. The frequency of use of the Air-to-Air Radar Modes (Question 14):

Always Used	
Range While Search (RWS)	85%
Single Target Track (STT)	85%
Non-Cooperative Target Recognition (NCTR)	60%
Electronic Counter-Counter Measures (ECCM)	50%
Auto Acquisition (AACQ)	50%

Sometimes Used	
Track While Scan (TWS)	75%
Vertical Acquisition (VACQ)	65%
Gun Acquisition (GACQ)	65%
Raid	50%

Rarely Used

Velocity Search (VS)	85%

8. The frequency of use of FLIR when integrated with the Air-to-Air radar modes (Question 15). Note: Four of the pilot responders indicated that they had never used FLIR so the percentages cited reflect only the responses of the 16 pilots with FLIR experience.

Always Used

Velocity Vector Slaved (VVSLV)	50%
Radar LOS Slaved (RRSLV)	50%
FLIR Autotrack	44%

Sometimes Used

Velocity Vector Slaved (VVSLV)	50%
Radar LOS Slaved (RRSLV)	50%
FLIR Autotrack	50%

Rarely Used

Inertial LOS Slaved	69%
Radar Offset LOS Slaved	56%

9. The frequency of use of the Air-to-Ground Radar Modes (Question 16):

Always Used

Doppler Beam Sharpened Patch (EXP2)	65%
Air-to-Ground Ranging (AGR)	65%
Real Beam Ground Map (MAP)	50%

Sometimes Used

Ground Moving Target (GMT)	60%
Sea Surface Search (SEA)	53%
Doppler Beam Sharpened Sector (EXP1)	50%
Medium Resolution Synthetic Aperture (EXP3)	50%

Rarely Used

Terrain Avoidance (TA)	95%
Precision Velocity Update (PVU)	55%

10. Pilot skills most likely to deteriorate with lack of practice (Question 17):

Throttle Designator Control operations	50%
A/A, A/G and general FLIR operations	45%
A/A targeting, radar setups	40%
HARM/SHRIKE/WALLEYE delivery	35%
Use of the Radar Elevation Switch	30%
Use of the Weapon Select Switch	20%
Use of the Chaff/Flare Dispenser Switch	20%

11. The capabilities that should be required of a deployable HOTAS trainer (Question 18):

HARM/WALLEYE delivery	70%
A/A targeting/radar sorting	40%
A/A missions against all types of bogeys	35%
FLIR sequences	25%
A/G weapons sequences/maneuvers	25%

SECTION V

CONCLUSIONS

The following conclusions and supporting rationale, relative to the development of a deployable HOTAS trainer, were drawn following review and analysis of the information extracted from relevant F/A-18 documentation, pilot interviews, HOTAS Task Questionnaires, and the Trainer Task Description Matrix.

1. GENERAL

a. Flight characteristics of the HOTAS deployable trainer should simulate the F/A-18C aircraft to the highest degree possible.

b. Suitable scenarios will be required for both Air-to-Air and Air-to-Ground Master Mode simulation. Training in Air-to-air tactics, both offensive and defensive, is considered the most important requirement for simulation followed closely by offensive and defensive Air-to-ground tactics.

c. Requirements for simulated gaming areas should include:

(1) Air-to-Air visual and radar environments which include varying types and numbers of adversary aircraft as well as incoming enemy heat-seeking and radar guided missiles.

(2) Air-to-Ground visual and radar geographical areas which include various tactical targets as well as active emitting and/or shooting AAA and SAM sites.

d. FLIR operation should be considered a high priority function to be simulated since fleet pilots get very little opportunity to practice its use. While FLIR is used primarily for day or night detection in the A/G Mode, it also has limited application in the A/A Mode which pilots expressed a need to have simulated.

e. Mixed scenarios that require the pilot to make rapid change-overs between Master Modes must be included in the software for the HOTAS trainer to provide the realistic simulation of actual combat situations. During the performance of many missions, the pilot may be required to make such mode changes to accommodate to changing tactical situations. For example, while flying an A/G mission in the A/G Mode, the pilot might encounter hostile aircraft. This will require an immediate switch to the A/A Mode to engage the threat, after which a switch back to the A/G Mode must be made for weapons delivery on the ground target.

f. The following HOTAS controls should be functionally simulated for the F/A-18 A/A and A/G Master Modes

Throttle	Control Stick
Throttle Designator Control Switch	A/A Weapon Select
Radar Elevation Switch	Sensor Control Switch
HARM Seq./FLIR FOV/Raid Switch	Gun/Missiles Trigger
Chaff/Fare Dispenser Switch	A/G Weapon Release
Switch	
Cage/Uncage Switch	

The NAV Master Mode is not included above because it was considered neither difficult nor complex by the pilots surveyed and was, therefore, given no priority for simulation.

g. The following HOTAS controls have insufficient supporting data to justify a requirement that they be functionally active:

Throttle	Control Stick
Communications Switch	Trim Switch (see note)
Speed Brake	Baro./Alt./Reset Switch
Automatic Throttle Control (ATC)	Auto Pilot/NWS Switch
Exterior Lights	

Note: Addition of a trim switch might be desirable if the fidelity of the F/A-18 flight characteristics is extremely high.

h. In addition to the required HOTAS controls cited above, the following controls, displays and indicators must be simulated to accomplish the desired training:

(1) Left and right DDIs with surrounding function pushbuttons
(2) ALR-67 Azimuth and Control Indicators
(3) Head Up Display (HUD)
(4) Horizontal Indicator (HI)
(5) Master Arm Panel
(6) ECM Control Panel
(7) Sensor Control Panel
(8) Shoot Cue
(9) Selected displays/controls/functions on the Upfront Control Panel
(10) Selected displays/controls/functions on the Integrated Fuel/Engine Indicator Panel
(11) Related, integrated HUD, Radar, Stores, Format, FLIR, HARM, Navigation, and ALR-67 displays and aural tones.

i. The Throttle Designator Controller (TDC) is the single most important HOTAS control. It is used to perform a multitude of functions in conjunction with other controls and displays, e.g. select radar modes and parameters, control radar operation, control cursor operation in various DDI displays, etc. The capability to simulate many of these interacting functions should be incorporated in the HOTAS trainer.

j. In order to include further operational realism into the trainer, the capability to degrade the performance of the HARM, FLIR, ALR-67, and other selected avionics systems should be incorporated into the software. The type and extent of degraded performance should be consistent with the emergency procedures cited in the NATOPS manual and with appropriate maintenance records.

k. In order to provide performance feedback for self evaluation, one or more of the following performance measures should be included in the HOTAS deployable trainer capabilities:

(1) A scoring system based on kill, no-kill, and miss distance performance
(2) A scoring system based on procedural accuracy
(3) Negative scoring for missed opportunities

2. AIR-TO-AIR OPERATIONS

a. To provide training in long range, (i.e. beyond visual) target acquisition in the Air-to-Air Master Mode, the APG-65 Multipurpose A/A, A/G Terrain Avoidance Radar System needs to be simulated. In the A/A Master Mode, the radar has the capability to operate in approximately 11 separate radar modes. At a minimum, the Range While Search (RWS) and Single Target Track (STT) should be simulated. Non-Cooperative Target Recognition (NCTR) is a sub-mode of the STT radar mode and should also be considered for simulation. Radar simulation is also required to provide pulse doppler illumination for firing the AIM-7 missile. Finally, while of a low priority, the Gun Acquisition (GACQ) mode should be simulated if the Vulcan 20 mm gun is included in the HOTAS trainer's weapons inventory.

3. AIR-TO-GROUND OPERATIONS

a. As in the case of the Air-to-Air Master Mode, in order to provide long range acquisition of targets in the Air-to-Ground Master Mode, the A/G radar must be simulated. This radar has the capability to operate in nine separate modes, however, only three of these modes seem to be used extensively, i.e. the Real Beam Ground Map (MAP), the Doppler Beam Sharpened Patch (EXP2(, and the Air-to-Ground Ranging (AGR) modes. These three radar modes should be simulated.

b. There is a high priority requirement for simulation of HARM missile delivery as both an offensive and defensive weapon, although it is used primarily as an A/G offensive missile. As is the case with FLIR, fleet pilots get little opportunity to practice delivery techniques for this particular weapon.

c. As stated above, FLIR should be included as an air-to-ground simulation capability.

4. DEFENSIVE OPERATIONS

a. There is a high priority requirement for the simulation and integration of defensive tactics into both A/A and A/G missions. Scenarios for defensive operations will be required for both types of mission. This defensive capability will

require an A/A environment that includes both simulated adversary aircraft firing heat-seeking and radar guided missiles as well as incoming AAA and SAM missiles fired from the ground. Also required will be an A/G environment with a variety of tactical targets as well as AAA and SAM sites that emit radar signals and fire weapons at the F/A-18.

b. To provide a defensive tactics training capability, the Chaff/Flare Dispenser Switch and its related functions will have to be simulated. In addition, there will be a requirement for the ALR-67 Radar Warning Receiver with its associated controls and display indicators.

SECTION VI

RECOMMENDATIONS

FOR THE

GENERIC N-V-M TRAINER

1. Top Priority - Ensure that the air-to-air offensive and defensive tactical capabilities of the generic trainer now being developed are acceptable and can be converted to F/A-18C operations with a minimum of effort when the HOTAS controls are integrated

2. Second priority - Improve the existing N-v-M displays by converting them to representations of actual F/A-18C displays.

3. Third priority - To the extent possible, add an air-to-ground capability to the generic N-V-M trainer.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Allen Corporation, F/A-18 Pilot Media Selection and Syllabus Report, Alexandria, VA, November, 1987

2. Allen Corporation, F/A-18 Objectives Hierarchies Report, Alexandria, VA, June 30, 1988

3. Allen Corporation, VFA-106 Replacement Pilot Orientation Manual, Alexandria, VA, Undated

4. Allen Corporation, F/A-18 Simulator Requirements Analysis, Alexandria, VA, December 1986

. Allen Corporation, F/A-18 Training Development and Support Plan, Alexandria, VA, November 30, 1981

6. Burtek, HOTASTA Design Review Report, Tulsa, OK, June 15, 1987

7. Burtek, Hands on Throttle and Stick Training Aid, Tulsa, OK, Undated Presentation

Chief of the Defence Staff, Maintenance Instructions: CF-18 Hands on Throttle and Stick Trainer, C-10-171-000/MM-001 Canadian Air Force, February 15, 1984

8. Chief of Naval Operations, F/A-18 Tactical Manual, Vol. I, A1-F18AC-TAC-000/(C), Washington, D.C., February, 1987

9. Chief of Naval Operations, F/A-18 Tactical Manual, Vol. II A1-F18AC-TAC-010/(C), Washington, D.C., February, 1987

10. Chief of Naval Operations, F/A-18 Tactical Manual, Vol. III, A1-F18AC-TAC-100/(S), Washington, D.C., February, 1987

11. Cmar, E.J., F/A-18 Weapons Tactics Trainer Device 2E7, Naval Training Systems Center, Orlando, FL, November 8, 1985

12. Frankenberger, K.A., et al, F/A-18 Hands on Throttle and Stick (HOTAS) Controls: A Study of Their Function and Complexity, Naval Weapons Center, China Lake, CA, August, 1988

13. McDonnell Aircraft Company, Operation of the F/A-18 Avionic Subsystem for F/A-18C/D Aircraft with 87X Operational Flight Programs, Saint Louis, MO, March 1, 1988

14. McDonnell Aircraft Company, F/A-18 Hands on Throttle and Stick Trainer, Saint Louis MO, Undated

15. Naval Air Systems Command, F/A-18A/B/C/D NATOPS Flight Manual, A1-F18AC-NFM-000, Washington, D.C., December 1, 1985

16. Naval Air Systems Command, F/A-18A/B/C/D Supplemental NATOPS Flight Manual, A1-F18AC-NFW-001, Washington, D.C., June 1, 1987

17. Naval Air Systems Command, F/A-18A and F/A-18B NATOPS Flight Manual Performance Charts, A1-F18AC-NFM-200, Washington, D.C., January 1, 1987

ACRONYMS

ACRONYMS

AAA	Anti-Aircraft Artillery
AACQ	Auto Acquisition
AGR	Air-to-Ground Ranging
AOA	Angle of Attack
ATC	Automatic Throttle Control
CAM	Camera
CRT	Cathode Ray Tube
DRLMS	Digital Radar Landmark Simulation
ECM	Electronic Countermeasures
ECCM	Electronic Counter Countermeasures
ER/DL	Extended Range/Data Link
EXP1	Doppler Beam Sharpened-Sector
EXP2	Doppler Beam Sharpened-Patch
EXP3	Medium Resolution Synthetic Aperture
FCS	Flight Control System
FLIR	Forward Looking Infrared
FOV	Field-of-View
GACQ	Gun Acquisition
GMT	Ground Moving Target
HARM	High Speed Anti-Radiation Missile
HI	Horizontal Indicator
HSI	Horizontal Situation Indicator
HUD	Head Up Display
IMC	Instrument Meteorological Condition
INS	Inertial Navigation System

L-DDI	Left Digital Display Indicator
LOS	Line-of-Sight
LST	Laser Spot Tracker
MAP	Real Beam Map
NCTR	Non-Cooperative Target Recognition
PB	Pull Back
PVU	Precision Velocity Update
RAID	Raid Assessment
R-DDI	Right Digital Display Indicator
RWR	Radar Warning Receiver
RWS	Range While Search
SAM	Surface to Air Missile
SEA	Sea Surface Search
SIM/AIRCRAFT	Simulator or Aircraft
SMS	Stores Management Set
SP	Self Protect
STT	Single Target Track
SURF	Surface
TA	Terrain Avoidance
TDC	Throttle Designator Control
TOO	Target of Opportunity
TWS	Track While Scan
UFC	Up Front Control
VACQ	Vertical Acquisition
VMC	Visual Meteorological Condition
VTRS	Video Tape Recording System
VVSLV	Velocity Vector Slaved

APPENDIX A

HOTAS TASK QUESTIONNAIRE

HOTAS TASK QUESTIONNAIRE

Introduction

The Naval Training Systems Center has been tasked to develop a deployable Hands on Throttle and Stick Part Task Trainer (HOTAS PTT) for the F/A-18 aircraft. This system will provide training and proficiency maintenance on those critical HOTAS skills that degrade during lengthy carrier deployments due to lack of practice. This trainer is not being designed to reduce your flight time in the aircraft. It is being developed as a device that will provide training and practice in areas that, for one reason or another, are not available on operational equipment (e.g., EW, HARM).

The first step in the development of the HOTAS PTT is to determine those critical skills that require the most practice to remain proficient in operating the F/A-18 HOTAS system. We request your assistance in providing this information because you are the experts with the F/A-18. You know the required tasks and their criticality. Therefore, we need your input at this early stage of development of the trainer so that it will provide the maximum benefit to you.

There are no right or wrong answers to any of these questions. This is not a test and you are not being evaluated. Your answers will remain strictly confidential. Please take the time to be as accurate as possible.

After we have analyzed this information, we will provide you with a detailed summary report of the results. These results are extremely important as they will help to determine the direction that the HOTAS PTT development will take. We will provide you with regular progress reports, and we hope that you will be able to provide hands on assistance with this trainer in the future. Your cooperation is greatly appreciated. Please call us if you have any questions or comments about this project. Thank you.

NTSC Points of Contact:

Naval Training Systems Center, Code 711
12350 Research Parkway
Orlando, Fl. 32826
ATTN: Dr. David H. Fowlkes or Dr. Patrick J. Moskal

phone: Commercial: (407) 380-4789
Autovon: 960-4789.

BACKGROUND INFORMATION

Please provide the following information:

RANK: _____ DATE: _____

SQUADRON: _____ AGE: _____

Type of aircraft you are currently flying: _____

Approximate total flight hours: _____

Total flight hours by aircraft type:

Aircraft Type	Hours

Total flight hours in the last six months:

Aircraft Type	Hours

Total simulator hours on the 15C13 (PTT) and 2E7 (WTT):

Simulator Type	Hours
15C13	
2E7	

HOTAS QUESTIONNAIRE

The following questions are all related to the effective use of the operational F/A-18 HOTAS controls and their associated displays in accomplishing a mission.

1. The F/A-18 HOTAS system has three Master Modes of operation: Air-to-Air (A/A), Air-to-Ground (A/G), and Navigation (NAV). Circle the letter of the mode that causes you to have the greatest difficulty using the HOTAS controls correctly?

   A. A/A mode
   B. NAV mode
   C. A/G mode

2. Circle the letter corresponding to Master Mode that involves the most complex HOTAS operations.

   A. A/A mode
   B. NAV mode
   C. A/G mode

PLEASE REFER TO THIS LIST OF HOTAS CONTROLS AS REQUIRED TO ANSWER THE FOLLOWING QUESTIONS.

HOTAS CONTROLS

A. Chaff/Flare Dispenser
B. Communication
C. Cage/Uncage
D. Speed Brake
E. Throttle Designator Controller (TDC)
F. Automatic Throttle Control (ATC)
G. HARM Sequence/FLIR FOV/RAID
H. Exterior Lights
I. Radar Elevation
J. Air-to-Air Weapon Select
K. Pitch and Roll Trim
L. Sensor Control (Castle switch)
P. Air-to-Ground Weapon Release
Q. Gun/Missile Trigger
R. Barometric Altitude Reset/ Undesignate/NWS
S. Autopilot/NWS disengage/ G-limiter Override

3. Please indicate the four HOTAS controls/modes that are the most important by entering the corresponding letters from the list above.

   1._____ 2._____ 3._____ 4._____

4. Please list the four HOTAS controls that require the most practice to be used correctly.

   1._____ 2._____ 3._____ 4._____

5. Please indicate which combination of HOTAS controls and/or modes are the <u>most difficult</u> to correctly set up (e.g., setting up the controls/displays so that you may lock on and fire a Sparrow missile). Do this by entering an X for each affected switch for each mode. Switches which are not used leave blank.

THROTTLES

	NAV	A/A	A/G	EW
1. Chaff/Flare Dispenser				
2. Communications				
3. Cage/Uncage				
4. Speed Brake				
5. Throttle Designator Control (TDC)				
6. Automatic Throttle Control (ATC)				
7. HARM Sequence/FLIRFOV/RAID				
8. Exterior Lights				
9. Radar Elevation				

CONTROL STICK

	NAV	A/A	A/G	EW
1. Air-to-Air Weapon Select				
2. Pitch and Roll Trim				
3. Sensor Control				
4. A/G Weapon Release				
5. Guns/Missiles Trigger				
6. Baro Alt. Reset/Undesignate/NWS				
7. Auto Pilot/NWS Disengage/G-limits Override				

8. Exterior Lights

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

Rating Scale

1	2	3	4	5
LOW		MODERATE		HIGH

9. Radar Elevation

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

10. Air-to-Air Weapon Select

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

11. Pitch and Roll Trim

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

12. Sensor Control

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

13. A/G Weapon Release

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

14. Gun/Missile Trigger

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

15. Barometric Altitude Reset/Undesignate/NWS

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

16. Autopilot/NWS Disengage/G-Limiter Override

DIFFICULTY: _____ FREQUENCY: _____PRACTICE:

6. Which combination of HOTAS controls do you need to set up the fastest? Under what situation?

7. Once set up, which combination or combinations of HOTAS controls presents the biggest challenge to use correctly?

8. What HOTAS pilot skills are the most likely to deteriorate without practicing?

9. What, if any, situations occur in which the HOTAS controls are commonly set up incorrectly? Please enter the combination of HOTAS controls that may be set up incorrectly?

10. Which of the HOTAS controls require <u>continuing practice to maintain proficiency</u>? Indicate from 1 to 9 for each mode, with "1" requiring the most practice.

THROTTLES

	NAV	A/A	A/G	EW
1. Chaff/Flare Dispenser				
2. Communications				
3. Cage/Uncage				
4. Speed Brake				
5. Throttle Designator Control (TDC)				
6. Automatic Throttle Control (ATC)				
7. HARM Sequence/FLIRFOV/RAID				
8. Exterior Lights				
9. Radar Elevation				

CONTROL STICK

	NAV	A/A	A/G	EW
1. Air-to-Air Weapon Select				
2. Pitch and Roll Trim				
3. Sensor Control				
4. A/G Weapon Release				
5. Guns/Missiles Trigger				
6. Baro Alt. Reset/Undesignate/NWS				
7. Auto Pilot/NWS Disengage/G-limits Override				

11. Assume that you are in the Air-to-Air Master Mode. For each HOTAS control listed below, please enter the <u>difficulty</u> in using the control, how often you would <u>use</u> it during an average mission, and how much <u>practice</u> is required to maintain your proficiency with it. Use the scale provided to make your ratings. Enter an "X" if a switch is not used

in this mode. For example, if you believe that using the throttle designator controller (TDC) is very difficult, you would place a "5" in the space provided. If you use it moderately frequently during a mission, you would enter a "3", and if you believe that the TDC requires little practice to maintain proficiency, enter a "1".

Rating Scale

1	2	3	4	5
LOW		MODERATE		HIGH

1. Chaff/Flare Dispenser

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

2. Communication

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

3. Cage/Uncage

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

4. Speed Brake

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

5. Throttle Designator Controller (TDC)

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

6. Automatic Throttle Control (ATC)

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

7. HARM Sequence/FLIR FOV/RAID

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

12. Assume that you are in the Air-to-Ground Master Mode. For each HOTAS control listed below, please follow the same instructions that you did in question number 11, but remember to rate the HOTAS controls as if you were in Air-to-Ground mode.

Rating Scale

```
1            2            3            4            5
:------------:------------:------------:------------:
LOW                       MODERATE                  HIGH
```

1. Chaff/Flare Dispenser

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

2. Communication

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

3. Cage/Uncage

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

4. Speed Brake

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

5. Throttle Designator Controller (TDC)

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

6. Automatic Throttle Control (ATC)

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

7. HARM Sequence/FLIR FOV/RAID

   DIFFICULTY: _____ FREQUENCY: _____PRACTICE: _____

Rating Scale

```
1             2             3             4             5
:-------------:-------------:-------------:-------------:
LOW                         MODERATE                    HIGH
```

8. Exterior Lights

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

9. Radar Elevation

   DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

10. Air-to-Air Weapon Select

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

11. Pitch and Roll Trim

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

12. Sensor Control

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

13. A/G Weapon Release

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

14. Gun/Missile Trigger

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

15. Barometric Altitude Reset/Undesignate/NWS

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

16. Autopilot/NWS Disengage/G-Limiter Override

    DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

13. In an electronic warfare environment, what [redacted] controls/displays are critical to successfully completing the mission? List the critical controls/displays.

A/A	A/G
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

14. The radar may operate in any of the following modes during an A/A attack. In the space provided for each mode, enter a "1" if it is always used, enter a "2" if it is sometimes used, or enter a "3" if the radar mode is rarely used during an operational mission.

Rating Scale

1	2	3
always used	sometimes used	rarely used

A. Range While Search (RWS): _____
B. Velocity Search (VS): _____
C. Track While Scan (TWS): _____
D. ACM Modes
   1. Wide Acquistion (WACQ): _____
   2. Vertical Acquistion (VACQ): _____
   3. Boresight (BST): _____
E. Gun Acquistion (GACQ): _____
F. Single Target Track (STT): _____
G. RAID Mode: _____
H. Auto Acquistion (AACQ): _____
I. Non-Cooperative Target Recognition (NCTR): _____
J. Electronic Counter-Countermeasures (ECCM): _____

Please enter any comments:

_____
_____
_____
_____
_____

15. FLIR, when integrated with the radar during A/A operations, may operate in any of the following modes. In the space provided for each mode, enter a "1" if it is always used, enter a "2" if it is sometimes used, or enter a "3" if the FLIR mode is rarely used during an operational mission.

Rating Scale

1	2	3
always used	sometimes used	rarely used

A. Velocity Vector Slaved (VVSLV): _____
B. Radar LOS Slaved (RRSLV): _____
C. Radar Offset LOS Slaved: _____
D. Inertial LOS Slaved: _____
E. FLIR Autotrack: _____

Please enter any comments:

_____
_____
_____
_____
_____

16. The following radar modes are available for use in A/G weapon delivery. In the space provided for each mode, enter a "1" if it is always used, enter a "2" if it is sometimes used, or enter a "3" if the radar mode is rarely used during a operational mission.

Rating Scale

1	2	3
always used	sometimes used	rarely used

A. Real Beam Ground Map (MAP): _____
B. Sea Surface Search (SEA): _____
C. Ground Moving Target (GMT): _____
D. Doppler Beam Sharpened Sector (EXP1): _____
E. Doppler Beam Sharpened Patch (EXP2): _____
F. Medium Resolution Synthetic Aperture (EXP3): _____
G. Precision Velocity Update (PVU): _____
H. Air-to-Ground Ranging (AGU): _____
I. Terrain Avoidance (TA): _____

Please enter any comments:

17. Please list the pilot HOTAS skills that <u>may deteriorate</u> due to lack of application or practice.

1. _____ 5. _____
2. _____ 6. _____
3. _____ 7. _____
4. _____ 8. _____

18. Assume that a HOTAS PART TASK TRAINER is deployed on ship and available for your use. It takes up little space and no instructor is required. What HOTAS functions (e.g., weapon systems, mission scenarios, HARM, etc.) would be required on this trainer in order for you to maintain and/or develop the necessary skills to successfully perform A/A, A/G, and EW missions?

19. Would a trainer similar in concept and capability to DEVICE 15C13 (F/A-18 PTT) be an acceptable deployed trainer if it was converted to a compact form? Why or why not?

20. What is the most difficult mission scenario that you must accomplish, and why is it difficult?

21. Please enter any additional comments below that you have about the development of a deployable HOTAS part-task trainer (suggestions, complaints, etc.). Remember, this trainer is to be capable of assisting you in maintaining your HOTAS skills when deployed.

APPENDIX B

QUESTIONNAIRE DATA SUMMARY

PART I

PILOT BACKGROUND SUMMARY INFORMATION

1. Sample Size

NAS Cecil Field	16
NAS Lemoore	4
Total	20

2. Personnel Data

	Mean	Range		
Rank	LT	LT	to	CAPT
Age	30	25		39

3. Flight Hours

Total	1,387.5	350	3,800
F/A-18	464.2	55	1,400
Last six months	116.5	50	200
In the 15C13	17.55	5	75
In the 2E7	42.9	10	150

PART II

QUESTIONNAIRE DATA SUMMARY

RESPONSE TOTALS AND MEANS

This part of the data summary is a compilation of the most frequent responses given in the questionnaire. Responses are listed either in the order of their frequency or, where ratings were called for, the average rating score. The frequency or rating average is shown after each response.

1. Master Modes causing greatest difficulty

a. A/A - 10 b. A/G - 8 c. NAV - 1

2. Master Modes considered most complex

a. A/A - 13 b. A/G - 7 c. NAV - 0

3. HOTAS controls/modes considered most important

a.	Throttle Designator Controller (TDC)	18
b.	Air-to-Air Weapon Select	14
c.	Sensor Control	10
d.	Gun/Missile Trigger	8
e.	Chaff/Flare Dispenser	4
f.	HARM Seq./FLIR FOV/Raid	4
g	A/G Weapon Release	4
h.	Communications	4

4. HOTAS controls requiring most practice

a.	Throttle Designator Control (TDC)	18
b.	Sensor Control	14
c.	Radar Elevation	13
d.	Air-to-Air Weapon Select	10
e.	Chaff/Flare Dispenser	9
f.	HARM seq./FLIR FOV/Raid	6
g.	Cage/Uncage	5

5. Controls/modes most difficult to set correctly

NAV Mode

a.	TDC	4
b.	Chaff/Flare Disp.	2
c.	HARM Sequence	2

A/A Mode

a.	TDC	13
b.	Radar Elevation	10
c.	Sensor Control	7
d.	Chaff/Flare Disp.	5
e.	Cage/Uncage	4
f.	A/A Weapon Select	4

A/G Mode

a.	HARM Sequence	12
b.	TDC	11
c.	Sensor Control	7
d.	Chaff/Flare Disp.	6

EW Mode

a.	Chaff/Flare Disp.	5
b.	HARM Seq./FLIR/Raid	5
c.	TDC	4
d.	Cage/Uncage	3

Ranking Over All Modes

a.	TDC	32
b.	HARM Sequence	19
c.	Chaff/Flare Disp.	18
d.	Sensor Control	14
e.	Radar Elevation	10
f.	Cage/Uncage	7
g.	A/A Weapon Select	4

6. Controls requiring fastest setup

a.	A/A weapon selection, radar setups, delivery	18
b.	Changing back and forth from A/A to A/G Modes	4
c.	Chaff/Flare Dispenser	3
d.	HARM delivery sequence	2
d.	TDC/Radar Elevation operation in A/A Mode	2

7. Biggest challenge to use correctly once set up

a.	TDC in both A/A and A/G Master Modes	6
b.	A/G weapon delivery (auto delivery, HARM sequence, getting weapon on highest priority target, etc.	4
c.	A/A weapon selection, radar setting,delivery	2

8. Skills most perishable without practice

a.	A/A weapon select, radar sorting, acquisition, targeting and delivery	14
b.	TDC Sequences	5
c.	HARM sequences/delivery	5
d.	A/G weapon delivery switching	2
e.	FLIR bombing	2

9. Control setups most likely to be done incorrectly

a.	No response	7
b.	A/G weapon delivery	6
c.	A/A radar modes, elevation selection, sensor control	4
d.	TDC operations	3
e	Use of Raid switch	2

10. Controls requiring continuous practice to maintain proficiency (Scale of 1 = most to 9 = least)

NAV Mode

a.	TDC	4.6
b.	HARM Sequence	4.6
c.	Chaff/Flare Disp.	5.4
d.	Baro. Altimeter	6.1
e.	Radar Elevation	6.2

A/A Mode

a.	TDC	2.7
b.	Chaff/Flare Disp.	3.2
c.	Sensor Control	3.3
d.	HARM Sequence	3.8
e.	Radar Elevation	3.8

A/G Mode

a.	TDC	2.4
b.	Chaff/Flare Disp.	3.2
c.	Sensor Control	3.3
d.	HARM Sequence	3.4
e.	Radar elevation	5.0

EW Mode

a.	Chaff/Flare Disp.	2.9
b.	HARM Sequence	4.1
c.	TDC	4.8
d.	Sensor Control	5.3

Ranking over all modes

a.	TDC	3.4
b.	Chaff/Flare Disp.	3.5
c.	HARM Sequence	3.9
d.	Sensor Control	4.3
e.	Radar Elevation	5.2

11. A/A Master Mode Rankings (Scale of 5 = high to 1 = low)

Difficulty		Frequency		Practice	
TDC	3.5	Communications	4.7	TDC	4.2
Radar Elev.	3.3	A/A Weapon Sel.	4.5	Chaff/Flare	3.4
HARM Seq.	2.8	TDC	4.4	Radar Elev.	3.4
Sensor Cont.	2.6	Sensor Control	4.0	HARM Seq.	3.1
Chaff/Flare	2.5	Radar Elev.	3.5	Sensor Cont.	3.1

12. A/G Master Mode Rankings (Scale of 5 = high to 1 = low)

Difficulty		Frequency		Practice	
TDC	3.4	Communications	4.7	TDC	3.8
HARM Seq.	2.9	TDC	3.9	Chaff/Flare	3.1
Chaff/Flare	2.7	A/G Weapon Sel.	3.6	HARM Seq.	3.0
Radar Elev.	2.4	Sensor Cont.	3.5	Sensor Cont.	2.9
Sensor Cont.	2.2	A/A Weapon Sel.	3.4	Radar Elev.	2.6

13. Most critical controls/displays in an EW environment

	Controls	A/A Mode	A/G Mode
a.	Chaff/Flare Dispenser	7	6
b.	Radar Elevation	5	-
c.	HARM Seq./FLIR FOV/Raid	4	7
d.	Throttle Designator Control	3	2
e.	Weapon Select	3	-
f.	Weapon Release	-	2

	Displays	A/A Mode	A/G Mode
a.	ALR-67	12	11
b.	HUD displays	7	9
c.	Radar displays	5	3
d.	EW displays	4	4
e.	ALQ-126	4	5
f.	HARM displays	3	3
g.	ALR-39	2	2
h.	Stores displays	2	2

14. Most frequently used radar modes during A/A operations (Scale of 1 = always used to 3 = rarely used)

a.	Single Target Track (STT)	1.0
b.	Range While Search (RWS)	1.2
c.	Non-Cooperative Target Recognition (NCTR)	1.3
d.	ACM Boresight (BST)	1.4
e.	Auto Acquisition (AACQ)	1.4

15. Most frequently used FLIR modes during A/A operations (Scale of 1 = always used to 3 = rarely used)

a.	Velocity vector Slaved (VVSLV)	1.5
b.	Radar LOS Slaved (RSLV)	1.5
c.	FLIR Auto Track	1.6

16. Most frequently used radar modes during A/G operations (Scale of 1 = always used to 3 = rarely used)

a.	Doppler Beam Sharpened Patch (EXP2)	1.3
b.	Air-to-Ground Ranging (AGR)	1.3
c.	Real Beam Ground Map (MAP)	1.5
d.	Medium Resolution Synthetic Aperture (EXP3)	1.7
e.	Doppler Beam Sharpened Sector (EXP1)	1.7

17. Skills that may deteriorate with lack of use

a.	Throttle Designator Control operations	10
b.	A/A, A/G and general FLIR operations	9
c.	A/A targeting, radar setups	8
d.	HARM/SHRIKE/WALLEYE delivery	7
e.	Use of the Radar Elevation Switch	6
f.	Use of the Weapon Select Switch	4
g.	Use of the Chaff/Flare Dispenser Switch	4

18. HOTAS functions that should be required in trainer

a.	HARM/WALLEYE delivery	14
b.	A/A targeting/radar sorting	8
c.	A/A missions against all types of bogeys	7
d.	FLIR sequences	5
e.	A/G weapons sequences/maneuvers	3

19. Would a 15C13 type trainer be acceptable?

Yes, but only with major added capability	12
No because:	7

a. Too simple, canned or perfect
b. Should be an OFT or WTT
c. Not all controls work
d. No visual displays
e. No HARM, FLIR, etc. capability
f. No A/G, EW capability

20. Most difficult mission scenarios

a. Self escorted, low altitude mission into a high threat (hostile air, SAM and AAA) environment with HARM/EW capability on board	14
b. Ability to perform FLIR operations	2
c. A/A missions against smart A/A threats	2

PART III

QUESTIONNAIRE DATA SUMMARY

RESPONSE PERCENTAGES

This part of the data summary cites the results of 12 survey items expressed in percentages of the pilots responding to the items.

1. QUESTION 1: Master modes causing greatest difficulty

   a. A/A - 53% A/G - 42% NAV - 5%

2. QUESTION 2: Master Modes considered most complex

   a. A/A - 65% A/G - 35% NAV - 0%

3. QUESTION 3: HOTAS controls/modes considered most important

   a. Throttle Designator Controller (TDC) 90%
   b. Air-to-Air Weapon Select 70%
   c. Sensor Control 50%
   d. Gun/Missile Trigger 44%

4. QUESTION 4: HOTAS controls requiring most practice

   a. Throttle Designator Controller 90%
   b. Sensor Control 70%
   c. Radar Elevation 65%
   d. Air-to-Air Weapon Select 50%
   e. Chaff/Flare Dispenser 45%

5. QUESTION 5: Controls/modes most difficult to set correctly

THROTTLES

	NAV	A/A	A/G	EW
a. Chaff/Flare Dispenser	11%	33%	28%	28%
b. Communications	-	-	-	-
c. Cage/Uncage	-	22%	11%	17%
d. Speed Brake	-	-	-	-
e. Throttle Designator Control (TDC)	22%	72%	61%	22%
f. Automatic Throttle Control (ATC)	5%	-	-	-
g. HARM Sequence/FLIR FOV/RAID	11%	17%	67%	28%
h. Exterior Lights	-	-	-	-
i. Radar Elevation	5%	55%	17%	-

CONTROL STICK

	NAV	A/A	A/G	EW
a. Air-to-Air Weapon Select	-	22%	-	-
b. Pitch and Roll Trim	5%	-	-	-
c. Sensor Control	-	39%	39%	5%
d. A/G Weapon Release	-	-	17%	-
e. Gun/Missile Trigger	-	11%	5%	-
f. Baro. Alt. Reset/Undesignate/NWS	-	11%	5%	-
g. Auto Pilot/NWS Disc./G-Limiter OR	5%	17%	5%	5%

6. QUESTION 10: Controls requiring continuous practice to maintain proficiency (Scale of 1 = most to 9 = least)

THROTTLES

Chaff/Flare Dispenser

	1	2	3	4	5	6	7	8	9
a. NAV	20%	20%	-	10%	10%	-	-	10%	30%
b. A/A	33%	17%	22%	6%	6%	-	5%	-	11%
c. A/G	38%	20%	7%	11%	11%	-	-	-	11%
d. EW	50%	20%	-	7%	7%	-	-	-	14%

Communications

	1	2	3	4	5	6	7	8	9
a. NAV	-	-	7%	-	-	-	7%	26%	26%
b. A/A	-	-	7%	-	-	7%	7%	21%	57%
c. A/G	-	-	7%	-	-	7%	21%	21%	43%
d. EW	-	-	11%	-	-	-	11%	22%	57%

QUESTION 10 (Continued)

Cage/Uncage

	1	2	3	4	5	6	7	8	9
a. NAV	-	-	-	-	14%	7%	7%	21%	50%
b. A/A	-	7%	21%	21%	14%	-	7%	7%	21%
c. A/G	-	-	8%	17%	17%	-	8%	17%	33%
d. EW	-	-	-	-	11%	11%	11%	11%	56%

Speed Brake

	1	2	3	4	5	6	7	8	9
a. NAV	-	-	7%	-	7%	-	7%	7%	71%
b. A/A	-	-	-	-	-	8%	11%	8%	71%
c. A/G	-	-	-	-	11%	-	18%	11%	56%
d. EW	-	-	-	-	-	12%	12%	12%	64%

Throttle Designator Control

	1	2	3	4	5	6	7	8	9
a. NAV	21%	14%	21%	-	7%	-	-	14%	21%
b. A/A	35%	29%	12%	12%	-	-	5%	-	5%
c. A/G	44%	22%	16%	6%	-	6%	-	-	6%
d. EW	-	22%	22%	22%	-	-	-	22%	11%

Automatic Throttle Control

	1	2	3	4	5	6	7	8	9
a. NAV	-	7%	-	7%	7%	-	7%	14%	57%
b. A/A	-	-	-	9%	9%	18%	-	18%	45%
c. A/G	-	-	-	9%	18%	9%	27%	9%	27%
d. EW	-	-	-	12%	12%	12%	-	12%	50%

HARM Sequence/FLIR FOV/Raid

	1	2	3	4	5	6	7	8	9
a. NAV	17%	-	17%	33%	8%	-	-	8%	17%
b. A/A	14%	21%	21%	14%	7%	-	7%	14%	-
c. A/G	25%	18%	25%	12%	-	6%	-	-	13%
d. EW	25%	18%	17%	8%	8%	-	-	-	25%

QUESTION 10 (Continued)

Exterior Lights

	1	2	3	4	5	6	7	8	9
a. NAV	-	-	-	-	-	-	14%	-	86%
b. A/A	-	-	-	-	-	-	-	36%	64%
c. A/G	-	-	-	-	-	-	18%	9%	72%
d. EW	-	-	-	-	-	-	-	22%	78%

Radar Elevation

	1	2	3	4	5	6	7	8	9
a. NAV	8%	8%	-	8%	15%	-	8%	23%	31%
b. A/A	22%	17%	17%	7%	5%	5%	-	-	17&
c. A/G	8%	15%	8%	31%	-	8%	-	8%	23%
d. EW	-	-	-	29%	14%	-	-	-	57%

CONTROL STICK

Air-to-Air Weapon Select

	1	2	3	4	5	6	7	8	9
a. NAV	-	-	11%	-	-	-	-	-	78%
b. A/A	10%	12%	23%	12%	6%	-	6%	-	23%
c. A/G	12%	-	13%	-	-	-	-	-	75%
d. EW	-	-	14%	-	14%	-	-	-	72%

Pitch and Roll Trim

	1	2	3	4	5	6	7	8	9
a. NAV	7%	-	-	-	-	6%	6%	21%	47%
b. A/A	10%	-	-	-	-	10%	-	20%	50%
c. A/G	10%	-	-	-	-	10%	-	20%	60%
d. EW	13%	-	-	-	-	12%	-	12%	63%

Sensor Control

	1	2	3	4	5	6	7	8	9
a. NAV	-	10%	10%	10%	10%	-	-	20%	40%
b. A/A	18%	23%	29%	12%	6%	-	-	6%	6%
c. A/G	27%	27%	13%	-	13%	6%	6%	6%	-
d. EW	11%	11%	11%	-	22%	11%	-	11%	22%

QUESTION 10 (Continued)

Air-to-Ground Weapon Release

	1	2	3	4	5	6	7	8	9
a. NAV	-	8%	8%	8%	-	-	-	8%	67%
b. A/A	-	6%	17%	6%	6%	-	-	-	58%
c. A/G	7%	9%	18%	9%	-	-	9	-	55%
d. EW	-	-	-	-	-	-	-	33%	67%

Gun/Missile Trigger

	1	2	3	4	5	6	7	8	9
a. NAV	-	-	-	-	22%	-	-	-	78%
b. A/A	7%	-	13%	-	20%	-	-	13%	47%
c. A/G	9%	-	-	18%	9%	-	-	9%	55%
d. EW	-	-	-	-	13%	13%	-	-	75%

Baro. Alt. Reset/Undesignate/NWS

	1	2	3	4	5	6	7	8	9
a. NAV	23%	7%	-	7%	-	-	-	7%	54%
b. A/A	-	7%	21%	-	14%	7%	-	7%	43%
c. A/G	7%	14%	14%	7%	7%	-	-	7%	43%
d. EW	-	8%	8	8%	-	-	-	8%	67%

Auto Pilot/NWS Disengage/G-Limiter Override

a. NAV	-	8%	8%	8%	-	-	-	8%	67%
b. A/A	-	6%	17%	6%	6%	-	-	-	58%
c. A/G	-	9%	18%	9%	-	-	9%	-	55%
d. EW	-	-	-	-	-	-	-	33%	67%

7. QUESTION 11: In the Air-to-Air Master Mode, rate each control for <u>difficulty in use, frequency of use, and practice required to maintain proficiency</u>. (Scale of 1 = low to 5 = high)

THROTTLES

<u>Difficulty</u>

	1	2	3	4	5
a. Chaff/Flare Dispenser	25%	20%	35%	15%	5%
b. Communications	85%	15%	-	-	-
c. Cage/Uncage	40%	20%	35%	5%	-
d. Speed Brake	100%	-	-	-	-
e. Throttle Desig. Cont.	10%	10%	20%	35%	25%
f. Auto Throttle Cont.	85%	10%	-	5%	-
g. HARM Seq./FLIR FOV/Raid	16%	21%	37%	16%	10%
h. Exterior Lights	95%	5%	-	-	-
i. Radar Elevation	10%	15%	35%	15%	25%

<u>Frequency</u>

	1	2	3	4	5
a. Chaff/Flare Dispenser	30%	10%	20%	15%	20%
b. Communications	5%	-	-	5%	90%
c. Cage/Uncage	15%	15%	40%	15%	15%
d. Speed Brake	30%	20%	20%	-	30%
e. Throttle Des. Cont.	-	-	20%	15%	65%
f. Auto Throttle Cont.	30%	30%	25%	10%	5%
g. HARM Seq./FLIR FOV/Raid	68%	16%	16%	-	-
h. Exterior Lights	70%	10%	5%	5%	10%
i. Radar Elevation	10%	10%	30%	15%	35%

<u>Practice</u>

	1	2	3	4	5
a. Chaff/Flare Dispenser	15%	10%	20%	25%	30%
b. Communications	65%	20%	-	-	15%
c. Cage/Uncage	30%	20%	20%	25%	5%
d. Speed Brake	85%	5%	5%	-	5%
e. Throttle Des. Cont.	5%	5%	15%	15%	60%
f. Auto Throttle Cont.	70%	25%	5%	-	-
g. HARM Seq./FLIR FOV/Raid	26%	16%	16%	5%	37%
h. Exterior Lights	85%	10%	-	-	5%
i. Radar Elevation	15%	15%	25%	5%	40%

QUESTION 11 (Continued)

CONTROL STICK

Difficulty

		1	2	3	4	5
a.	A/A Weapon Select	60%	30%	5%	5%	-
b.	Pitch and Roll Trim	85%	10%	5%	-	-
c.	Sensor Control	20%	30%	30%	10%	10%
d.	A/G Weapon Release	88%	6%	6%	-	-
e.	Gun/Missile Trigger	85%	5%	10%	-	-
f.	Baro Alt Reset/Undes/NWS	80%	10%	5%	5%	-
g.	AP/NWS Dis/G-Limiter OR	75%	15%	-	10%	-

Frequency

		1	2	3	4	5
a.	A/A Weapon Select	-	-	15%	20%	65%
b.	Pitch and Roll Trim	45%	15%	10%	5%	25%
c.	Sensor Control	5%	-	25%	25%	45%
d.	A/G Weapon Release	17%	23%	35%	6%	17%
e.	Gun/Missile Trigger	21%	10%	42%	6%	21%
f.	Baro Alt Reset/Undes/NWS	26%	5%	32%	10%	26%
g.	AP/NWS Dis/G-Limiter OR	50%	16%	26%	-	-

Practice

		1	2	3	4	5
a.	A/A Weapon Select	30%	20%	20%	20%	10%
b.	Pitch and Roll Trim	80%	10%	5%	5%	-
c.	Sensor Control	20%	20%	10%	30%	20%
d.	A/G Weapon Release	47%	23%	12%	6%	12%
e.	Gun/Missile Trigger	63%	10%	10%	6%	10%
f.	Baro Alt Reset/Undes/NWS	74%	5%	16%	-	5%
g.	AP/NWS Dis/G-Limiter OR	84%	5%	5%	5%	-

8. QUESTION 12: In the Air-to-Ground Master Mode, rate each control for <u>difficulty in use, frequency of use, and practice required to maintain proficiency</u>. (Scale of 1 = low to 5 = high)

THROTTLES

<u>Difficulty</u>

		1	2	3	4	5
a.	Chaff/Flare Dispenser	25%	15%	35%	15%	10%
b.	Communications	95%	5%	-	-	-
c.	Cage/Uncage	84%	10%	6%	-	-
d.	Speed Brake	95%	5%	-	-	-
e.	Throttle Desig. Cont.	5%	25%	20%	25%	25%
f.	Auto Throttle Cont.	85%	15%	-	-	-
g.	HARM Seq./FLIR FOV/Raid	26%	10%	32%	10%	21%
h.	Exterior Lights	95%	5%	-	-	-
i.	Radar Elevation	35%	15%	25%	20%	5%

<u>Frequency</u>

		1	2	3	4	5
a.	Chaff/Flare Dispenser	25%	20%	25%	20%	10%
b.	Communications	5%	-	-	10%	85%
c.	Cage/Uncage	35%	20%	25%	15%	5%
d.	Speed Brake	55%	5%	10%	10%	20%
e.	Throttle Des. Cont.	-	10%	30%	20%	40%
f.	Auto Throttle Cont.	60%	10%	25%	-	5%
g.	HARM Seq./FLIR FOV/Raid	42%	26%	21%	10%	-
h.	Exterior Lights	85%	-	5%	5%	5%
i.	Radar Elevation	35%	15%	25%	20%	5%

<u>Practice</u>

		1	2	3	4	5
a.	Chaff/Flare Dispenser	20%	20%	10%	15%	30%
b.	Communications	80%	5%	5%	-	10%
c.	Cage/Uncage	70%	10%	5%	-	15%
d.	Speed Brake	90%	5%	-	-	5%
e.	Throttle Des. Cont.	5%	15%	20%	15%	45%
f.	Auto Throttle Cont.	80%	15%	5%	-	-
g.	HARM Seq./FLIR FOV/Raid	26%	16%	16%	10%	33%
h.	Exterior Lights	95%	-	-	-	5%
i.	Radar Elevation	35%	15%	20%	10%	20%

QUESTION 12 Continued)

CONTROL STICK

Difficulty

	1	2	3	4	5
a. A/A Weapon Select	68	10%	21%	-	-
b. Pitch and Roll Trim	84%	10%	6%	-	-
c. Sensor Control	30%	30%	30%	10%	-
d. A/G Weapon Release	89%	-	11%	-	-
e. Gun/Missile Trigger	55%	-	5%	-	-
f. Baro Alt Reset/Undes/NWS	90%	5%	5%	-	-
g. AP/NWS Dis/G-Limiter OR	80%	5%	5%	5%	5%

Frequency

	1	2	3	4	5
a. A/A Weapon Select	12%	19%	12%	19%	38%
b. Pitch and Roll Trim	47%	-	21%	10%	21%
c. Sensor Control	-	15%	40%	25%	20%
d. A/G Weapon Release	11%	5%	37%	11%	37%
e. Gun/Missile Trigger	32%	26%	10%	5%	26%
f. Baro Alt Reset/Undes/NWS	24%	18%	35%	11%	11%
g. AP/NWS Dis/G-Limiter OR	65%	15%	15%	5%	-

Practice

	1	2	3	4	5
a. A/A Weapon Select	29%	35%	18%	6%	12%
b. Pitch and Roll Trim	21%	79%	5%	5%	-
c. Sensor Control	20%	20%	15%	35%	10%
d. A/G Weapon Release	67%	-	11%	-	22%
e. Gun/Missile Trigger	63%	16%	16%	-	5%
f. Baro Alt Reset/Undes/NWS	68%	26%	6%	-	-
g. AP/NWS Dis/G-Limiter OR	85%	10%	5%	-	-

9. QUESTION 13: List the critical controls and displays in an EW environment

Controls	A/A Mode	A/G Mode
a. Chaff/Flare Disp. Switch	35%	30%
b. Radar Elevation Switch	25%	10%
c. HARM Seq./FLIR/Raid	20&	35%
d. Throttle Designator Cont.	15%	10%
e. Weapon Select Switch	15%	-%
f. Weapon Release Switch	-	10%

Displays		
a. ALR-67 with HUD	60%	55%
b. HUD displays	35%	45%
c. Radar Displays	25%	15%
d. EW displays	20%	20%
e. ALQ-126	20%	25%
f. ALE-39	20	20%
g. HARM display	15%	15%
f. Stores display	10%	10%

10. QUESTION 14: Identify the frequency of use of the radar modes in the A/A Master Mode

Mode	Always	Sometimes	Rarely
a. Single Target Track (STT)	85%	15%	-
b. Range While Search (RWS)	85%	10%	5%
c. Non-Coop Target Recog. (NCTR)	60%	35%	5%
d. Elect Count-Count Meas. (ECCM)	60%	25%	15%
e. ACM Boresight (BST)	55%	30%	15%
f. Auto Acquisition (AACQ)	50%	45%	5%
g. ACM Vertical Acquisition (VACQ)	30%	65%	5%
h. Raid	25%	50%	25%
i. ACM Wide Acquisition (WACQ)	20%	45%	35%
j. Gun Acquisition (GACQ)	15%	65%	20%
k. Track While Scan (TWS)	10%	75%	15%
l. Velocity Search (VS)	-	15%	85%

QUESTION 14 (Continued)

11. QUESTION 15: Identify the frequency of use of the FLIR modes when integrated with radar available in the A/A Master Mode

Mode	Always	Sometimes	Rarely
a. Velocity Vector Slaved (VVSLV)	50%	50%	-
b. Radar LOS Slaved (RRSLV)	50%	50%	-
c. FLIR Autotrack	44%	50%	6%
d. Radar Offset LOS Slaved	6%	38%	56%
e. Inertial LOS Slaved	6%	25%	69%

Note: Four pilots indicated they had never used FLIR.

12. QUESTION 16: Identify the frequency of use of the FLIR modes when integrated with the radar available in the A/G Master Mode

Mode	Always	Sometimes	Rarely
a. Doppler Beam Sharpened Patch (EXP2)	65%	35%	-
b. Air-to-Ground Ranging (AGR)	65%	30%	-
c. Real Beam Ground Map (MAP)	50%	40%	10%
d. Doppler Beam Sharpened Sector EXP1)	35%	50%	15%
e. Medium Res. Syn. Aperture (EXP 3)	35%	50%	15%
f. Sea Surface Search (SEA)	26%	53%	21%
g. Ground Moving Target (GMT)	10%	60%	30%
h. Precision Velocity Update (PVU)	10%	35%	55%
i. Terrain Avoidance (TA)	-	5%	95%

13. QUESTION 17: Identify the pilot skills most likely to deteriorate with lack of practice.

a.	Throttle Designator Control operations	50%
b.	A/A, A/G and general FLIR operations	45%
c.	A/A targeting, radar setups	40%
d.	HARM/SHRIKE/WALLEYE delivery	35%
e.	Use of the Radar Elevation Switch	30%
f.	Use of the Weapon Select Switch	20%
g.	Use of the Chaff/Flare Dispenser Switch	20%

14. QUESTION 18: What <u>training capabilities should be required of a HOTAS deployable part task trainer</u>?

a.	HARM/WALLEYE delivery	70%
b.	A/A targeting/radar sorting	40%
c.	A/A missions against all types of bogeys	35%
d.	FLIR sequences	25%
e.	A/G weapons sequences/maneuvers	25%

APPENDIX C

TRAINER TASK DESCRIPTION MATRIX

References

F-18 Pilot Objectives Hierarchy Report, 6/30/88 - Primary source for tasks

MDC B0528, Operation of F/A-18 Avionics Subsystems with 87X-OFPs, 3/1/88, Primary Source of Technical Information

A1-F18AC-NFM-100/(c), Supplemental NATOPS - Supplemental source of Technical Information

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.0	PERFORM AIR-TO-GROUND TACTICS	Sim/Aircraft Airborne; single/multi-plane flight; all weapons/configuration available; day/night; IMC/VMC condition		Aircraft flight dynamics, Mission Computer function, Command Launch Computer function HUD, DDI, HI, HOTAS functions	High
1.1	PERFORM A/G COMBAT CHECKS	Sim/Aircraft equipped with A/G Weapons			High
1.1.1	SET UP COCKPIT FOR A/G WEAPON DELIVERY				
1.1.1.1	Select A/G Master Mode		Master Arm Panel with switches L-DDI-Store Management Display		
1.1.1.2	Activate Master Arm Switch		Master Arm Switch		
1.1.1.3	Check status of A/G weapons		L-DDI-Stores Format Displays		
1.1.1.4	Set up ECM equipment	Sim/Aircraft equipped with ECM equipment	Sensor control panel with switches	ALQ-126B Countermeasure Set functions ALE-39 Dispensing Set functions ALR-67 Radar Warning Receiver (RWR) functions	High
1.2	NAVIGATE TO TARGET	Sim/Aircraft airborne; operate INS, Radar day/night; IMC/VMC conditions			
1.2.1	PERFORM VISUAL NAVIGATION	Sim/Aircraft on preplanned DR route	HUD - Navigation display HI-HSI display, MAP display	Visual geographic area with landmarks, targets	High
1.2.1.1	Interpret HUD and HSI displays				
1.2.1.2	Assign TDC to HI to slew map		Sensor Control Switch on control stick, TDC on throttles		
1.2.2	PERFORM RADAR NAVIGATION	Sim/Aircraft Airborne, Operable A/G radar		Digital radar landmass for selected geographical area	Medium
1.2.2.1	Turn on radar		Sensor Control Panel - Radar Switch		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.2.2.2	Select A/G radar operation		SURF switch on radar format - R.DDI R.DDI - Map format		
1.2.2.3	Assign TDC to radar	Operable HOTAS system	Sensor Control Switch TDC		
1.2.2.4	Select Alternate A/G radar modes as required		R.DDI - MAP, EXP1, EXP2, EXP3 SEA, GMT - display formats		
1.2.2.5	Change gain, beam, antenna elevating range scale, azimuth scan as necessary			A/G radar functions	
1.2.2.6	Interpret displays and symbology				
1.2.3	OPERATE FLIR	Sim/Aircraft Airborne; equipped with FLIR pod mounted sensor; FLIR type targets available		Infrared targets in simulated environment	Medium
1.2.3.1	Turn on FLIR power		Sensor control panel - FLIR switch		
1.2.3.2	Select FLIR Display		DDI - FLIR button		
1.2.3.3	Assign TDC to FLIR		Sensor Control Switch		
1.2.3.4	Command FLIR to search		DDI - VVSLV display Cage/Uncage Switch		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.2.3.5	Select options as desired		DDI - Displays HUD - FLIR reticle display		
1.2.3.6	Designate FLIR target				
1.2.3.6.1	Reposition FLIR LOS		TDC HUD - display		
1.2.3.6.2	Acquire target		Sensor Control Switch DDI - FLIR display	A/G radar functions	
1.2.3.7	Designate new target/aim point		TDC DDI - FLIR display		
1.3	DESIGNATE OAP/TARGET	Sim/Aircraft Airborne; in target area-within range of on-board sensor	R.DDI - Sensor displays HUD - Navigation displays		
1.3.1	PERFORM VISUAL DETECTION/DESIGNATION	Sim/Aircraft within visual sighting range Conditions conducive to visual detection		Visual environment with targets available	High
1.3.2	PERFORM RADAR DETECTION/DESIGNATION	Sim/Aircraft Airborne with A/G radar capability; targets within radar range; suitable for radar detection	R.DDI - Radar displays HUD TDC	Radar landmass environment with radar targets	High
1.3.3	PERFORM FLIR DETECTION/DESIGNATION	Sim/Aircraft Airborne; target and environment suitable for FLIR	R.DDI - FLIR displays FLIR FOV Switch on throttle HUD TDC	FLIR pod capability	Medium

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.3.4	PERFORM LST DETECTION/ DESIGNATION	Target being illuminated by airborne or ground designation	R.DDI - LST/CAM Displays HUD - LST displays TDC	LST pod capability	Low
1.3.5	PERFORM EW/HARM DETECTION/ DESIGNATION	Sim/Aircraft Airborne; HARM on-board; within detection range of ground/airborne emitters	R.DDI - Radar displays HUD RWR - Displays and tones	HARM Pod Capability RWR EW environment	High
1.3.6	PERFORM DATA LINK DETECTION/ DESIGNATION	Sim/Aircraft Airborne; Configured for data link detection	R.DDI - Radar displays - data link overlays HUD	Data link environment	Low
1.4	PERFORM TARGET ACQUISITION				
1.4.1	PERFORM HARM ACQUISITION	Sim/Aircraft Airborne; within range of enemy ground emitters; aircraft configure with HARM	R.DDI - Radar displays HUD RWR - Displays	Hositle emitter environment, AAA sites, SAM sites. HARM sensor functions RWR functions	High
1.4.2	PERFROM WALLEYE ACQUISITION	Sim/Aircraft Airborne; targets suitable for Walleye; aircraft configured with Walleye I or Walleye ER/DL	L-DDI-Walleye displays HUD	Walleye visual environment For Walleye ER/DL - function of AWW-9. Data Link Pod Required	Low
1.4.3	PERFROM MAVERICK ACQUISITION	Sim/Aircraft Airborne configured for Maverick delivery	L.DDI - Maverick format displays	Suitable targets available Laser designation of target	Low

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.5	PERFORM HARM DELIVERY	Sim/Aircraft Airborne; within range of enemy ground emitters. Aircraft configured with HARM missiles		Visual/Radar geographical area with enemy emitters (targets)	High
1.5.1	SELECT HARM OPTIONS				
1.5.1.1	Select Pre-Briefed mode (PB)		L.DDI - Stores Format(PB Mode) TOO (Mode), (SP Mode) Sensor Switch TDC		
1.5.1.2	Select Target-of-Opportunity Mode (TOO)				
1.5.1.3	Select Self Protect (SP)/Pullback (PLBK) Mode				
1.5.2	ASSIGN TDC TO HUD				
1.5.3	CHECK STATUS OF WEAPONS		L.DDI-Stores Format		
1.5.4	PERFORM HARM SEQUENCE FOR ALTERNATE TARGETS		HARM Sequence Switch on Throttle		
1.5.5	SELECT PRIORITY HARM FOR DELIVERY				
1.5.6	PERFORM PRE-BRIEFED (PB) HARM DELIVERY	Pre-Planned Target	Sensor Switch TDC HI with HSI display	HARM seeker sensor functions	High

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.5.6.1	Assign TDC to Horizontal Indicator (HI)		L.DDI - HARM PB format HUD - PB Mode display		
1.5.6.2	Enter Target Number		Up Font Control (UFC)		
1.5.6.3	Select Pullup Option				
1.5.6.3.1	Select A/C Pullup		HUD - Pullup Display		
1.5.6.3.2	Select HARM Pullup		HUD - Pullup Display		
1.5.6.4	Confirm Target	Target acquired. Conditions ready for Launch			
1.5.6.5	Activate Weapon Release button		Weapon Release button on Control Stick		
1.5.6.6	Perform pullup maneuver				
1.5.6.7	Observe HARM delivery to target				
1.5.7	PERFORM TOO HARM DELIVERY DELIVERY	Sim/Aircraft Airborne. Target detected and designated. Aircraft in vicinity of target.			High
1.5.7.1	Assign TDC to HARM		TDC Sensor Control Switch		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.5.7.2	Select HARM mode		L.DDI - Stores Format Display		
1.5.7.3	Select HARM TOO Mode		DDI - HARM Display HUD - HARM TOO Format		
1.5.7.4	Interpret display for priority target			HARM sensor seeker function	
1.5.7.5	Perform HARM sequencing for alternate targets		HARM Sequence Switch on Throttle		
1.5.7.6	Reselect priority target				
1.5.7.7	Enter Class and type of target		DDI displays and DDI buttons		
1.5.7.8	Hand off priority target to missile		Cage/Uncage Switch on Control Stick		
1.5.7.9	Navigate to within range of target		HI-HSI format		
1.5.7.10	Acquire Aimpoint				
1.5.7.11	Determine target within launch parameters				
1.5.7.12	Launch HARM		Weapons Release Switch		
1.5.7.13	Repeat launch procedure				

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.5.8	PERFORM SELF PROTECT (SP)/PULLBACK (PLBK) DELIVERY	Sim/Aircraft Airborne configured with HARM. Hostile environment threat detected		Hostile environment - active AAA and/or SAM sites	High
1.5.8.1	Recognize Self-Protect Threat		RWR displays and tones L.DDI - Stores Format (HARM), SP Format HUD - SP HARM mode display	RWR Functions	
1.5.8.2	Sequence to other Self-Protected Targets		HARM Sequence Switch DDI - HARM delivery display		
1.5.8.3	Return to highest priority threats indicated on Radar Warning Receiver (RWR)		Reset button on DDI/SP format display		
1.5.8.4	Launch HARM		Weapons Release button on Control Stick		
1.5.8.5	Recognize Pullback Threat				
1.5.8.6	Launch HARM				
1.6	PERFORM WALLEYE DELIVERY	Sim/Aircraft Airborne. Target appropriate for Walleye. Aircraft configured with Walleye missiles, Day, VMC conditions		Visual environment with contrast-ing targets, suitable for Walleye detection and lock-on	Low
1.6.1	SELECT OPTIONS		L.DDI - Stores Format		
1.6.1.1	Select Walleye I		DDI - Walleye I format display and buttons HUD - Walleye I symbology		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.6.1.2	Select Walleye ER/DL		DDI - Walleye ER/DL format display HUD - Walleye ER/DL format display		
1.6.2	TURN ON A/G MASTER MODE		Master Mode Panel		
1.6.3	TURN ON MASTER ARM		Master Arm Switch		
1.6.4	PERFORM WALLEYE I DELIVERY		TDC Sensor Control Switch		
1.6.4.1	Uncage Missile		Cage/Uncage Switch on throttle		
1.6.4.2	Acquire Target				
1.6.4.3	Insure missile lock-on to target				
1.6.4.4	Launch Missile		Weapon Release Switch		
1.6.5	PERFORM SINGLE AIRCRAFT WALLEYE ER/DL DELIVERY Launch procedures same as Walleye I	Sim/Aircraft Airborne; programed for data link delivery; in range of target; configured with Walleye I, Day, VMC conditions	L.DDI - Walleye ER/DL Weapons and Pod format TDC Cage/Uncage Switch HUD - Same as for Walleye I Sensor Control Switch	Data Link Pod functions	Low

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.6.6	PERFORM SECTION ER/DL DELIVERY Launch procedures same as Walleye I Controller aircraft guides missile after launch	Two Sim/Aircraft Airborne; one aircraft to serve as delivery aircraft, the other as controller (pod) aircraft. In range of target	Same as above	Two aircraft functions, with programmed data link	Low
1.7	PERFROM MAVERICK DELIVERY	Sim/Aircraft Airborne; in target vicinity Maverick delivery appropriate (Laser designation)		Visual environment.. Laser target designation functions. Simulated Laser Spot tracker (LST) pod	Low
1.7.1	TURN ON A/G MASTER MODE		Master Mode Panel		
1.7.2	TURN ON MASTER ARM		Master Arm Switch Sensor Control Panel		
1.7.3	SELECT MAVERICK MISSILE		L.DDI - Maverick Video Format R.DDI - Radar display		
1.7.4	DESIGNATE TARGET	Laser-Detector-Tracker (LDT) capability	HUD - Maverick Display		
1.7.4.1	Assign TDC to Maverick for scanning mode		Sensor Control Switch TDC		
1.7.4.2	Slave Maverick to target				
1.7.4.2.1	Depress Cage/Uncage Switch		Cage/Uncage Switch		
1.7.4.3	Perform target lock-on				
1.7.4.3.1	Depress TDC		TDC		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
1.7.5	MANEUVER AIRCRAFT FOR LAUNCH CRITERIA				
1.7.6	LAUNCH MAVERICK		Weapons Release Button		
1.7.7	REPEAT LAUNCH PROCEDURE				
1.8	PERFORM STRAFING	Sim/Aircraft Airborne; target detected and designated; situation appropriate for gun		Gun mode capability, visual environment with appropriate targets	Low
1.8.1	SELECT GUN OPTION		L.DDI - Store management display button		
1.8.2	SELECT MODE OF OPERATION, CCIP OR MANUAL		L.DDI - Mode Button HUD - CCIP or Manual mode gun display		
1.8.3	MANEUVER AIRCRAFT TO POSITION RETICLE ON TARGET		HUD - Gun display		
1.8.4	FIRE GUN		Trigger Switch on Control Stick		
1.8.5	PERFORM BREAKAWAY/PULLUP MANEUVER		HUD - Gun Display		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.0	PERFORM AIR-TO-AIR TACTICS	Sim/Aircraft mission ready aircraft armed with AIM-7, AIM-9 and Gun. Single/multi plane flight		A/A visual/radar environment, maneuvering targets, Mission Computer functions, aircraft flight dynamics, Stores Management set functions	High
2.1	PERFORM PRE-A/A COMBAT CHECKS				
2.1.1	SET-UP COCKPIT FOR A/A WEAPONS DELIVERY				
2.1.1.1	Turn on radar		Sensor control panel - Radar Switch		
2.1.1.2	Turn on A/A Master Mode		A/A Master Mode Switch or A/A Weapon Select Switch on Control Stick R-DDI - Radar display for selected weapons		
2.1.1.3	Perform missile checks	Sim/Aircraft armed with AIM-7 and AIM-9 missiles	L.DDI - Stores format		
2.1.1.4	Set up ECM Equipment	Sim/Aircraft ECM equipment installed	Sensor Control Panel with switches	ALQ-126B Countermeasure Set Functions	
2.1.1.5	Check radar for A/A mission		R.DDI - Radar Display modes Radar Push button controls or TDC	A/A Radar Environment	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.1.1.6	Set up data link	Sim/Aircraft with standard data link equipment installed		Ground or air data link capability	Low
2.2	PERFORM MEDIUM RANGE INTERCEPT				High
2.2.1	PERFORM A/A TARGET SEARCH	Sim/Aircraft Airborne; medium range targets available	HUD - Navigation displays R.DDI - Radar displays	A/A environment	High
2.2.1.1	Operate radar in search	A/A environment; operable A/A radar	Sensor control switch TDC	A/A radar environment with maneuvering targets	
2.2.1.1.1	Select radar modes		R.DDI - Radar Modes Displays- RWS, VS, TWS, ACM, GACO, STT RAID, AACQ, NCTR, ECCM	A/A Radar Capability	
2.2.1.1.2	Change Channels	Various threat situations require change in radar channel	R.DDI - Push button		
2.2.1.1.3	Select silent options	Various threat situations; tactical situations; requires use of silent options	R.DDI - Push Button TDC	Maneuvering Targets	Low
2.2.2	INTERPRET SEARCH DISPLAYS	Sparrow/Sidewinder search display on DDI	R.DDI - Radar search display HUD		High
2.2.2.1	Identify cues/symbology in search		R.DDI HUD		
2.2.2.2	Identify targets		R.DDI HUD	A/A environment, maneuvering targets	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.2.3	PERFORM RADAR TARGET ACQUISITION	Sim/Aircraft Airborne; targets within range	R.DDI - Radar Display HUD		High
2.2.3.1	Interpret track display				
2.2.3.2	Perform target lock-on				
2.2.3.3	Respond to acquisition track				
2.2.4	FLY INTERCEPT PROFILE		R.DDI - Radar Display HUD	Air-to-air threat environment	High
2.2.4.1	Perform intercept approach phase				
2.2.4.1.1	Select tactics				
2.2.4.1.2	Turn on Master Arm		Master Arm switch		
2.2.4.2	Perform intercept attack phase	Radar lock-on and tracking target			High
2.2.4.2.1	Select intercept tactics				
2.2.4.2.2	Perform head-on attack	Head-on aspect			
2.2.4.2.3	Perform head-on reattack	Situation appropriate for reattack			
2.2.4.2.4	Perform forward quarter attack	Radar locked-on and tracking; forward quarter aspect.			
2.2.4.2.5	Perform forward quarter reattack	Situation appropriate for reattack			

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.2.4.2.6	Perform beam attack	Beam Aspect			
2.2.4.2.7	Perform beam attack reattack	Situation appropriate for beam reattack			
2.2.4.2.8	Perform rear quarter attack	Tracking target in rear quarter			
2.2.4.2.9	Perform stern attack	Tracking target in stern quadrant			
2.2.4.2.10	Perform VID	Requirement exists for visual identification of target		Target in visual environment	
2.2.4.2.11	Perform data link intercept	Data link pod installed and operational		Data link pod functions	Low
2.3	PERFORM A/A WEAPONS DELIVERY				
2.3.1	PERFORM AIM-7 (SPARROW) LAUNCH	Sim/Aircraft Airborne; target acquired on radar or visually; target confirmed as threat; aircraft configured with AIM-7 missiles		Visual air-to-air environment with threat aircraft 2-3 miles visibility	High
2.3.1.1	Set up weapon system				
2.3.1.1.1	Select AIM-7 missile		Weapon Select Switch - on control stick L.DDI - AIM-7 display R.DDI - Radar display	SMS functions MC functions	
2.3.1.1.2	Acquire target		HUD - Sparrow Format, Steering Displays		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.3.1.1.3	Follow steering dot on HUD	Target within missile range			
2.3.1.2	Perform final attack steering		HUD - Steering display R.DDI - Radar display (STT)		
2.3.1.2.1	Verify target parameters (range, velocity)	No radar jamming encountered	HUD - SHOOT display		
2.3.1.3	Initiate AIM-7 missile launch		Trigger - on control stick SHOOT cue on HUD and DDI display	Targets in air-to-air environment	High
2.3.1.3.1	Turn on Master Arm Switch		Master Arm Switch		
2.3.1.3.2	Verify launch parameters		HUD - Display R.DDI - Radar display - STT mode		
2.3.1.3.3	Identify cockpit cues for in-envelope verification. SHOOT cue on				
2.3.1.3.4	Launch AIM-7		Trigger switch		
2.3.1.3.5	Maintain post-launch guidance				
2.3.1.3.6	Sequence to next weapon		Weapon Select Switch		
2.3.1.4	Assess weapon effects			Hit, miss distance Missile in range, etc.	Medium

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.3.2	PERFORM AIM-9 (SIDEWINDER) LAUNCH	Sim/Aircraft airborne; final phase of Sidewinder attack; VMC; aircraft configured with AIM-9 missiles		Visual air-to-air environment target aircraft emitting IR energy	High
2.3.2.1	Set up weapon system				
2.3.2.1.1	Select AIM-9 missile		Weapon Select Switch L.DDI-AIM-9 Stores Format R.DDI-Radar displays HUD-Steering displays		
2.3.2.1.2	Turn on Master Arm Switch		Master Arm Switch		
2.3.2.2.	Perform seeker head/target lock-on				
2.3.2.2.1	Perform radar slaved lock-on		R.DDI - Radar Displays HUD - Steering displays	Aurel tone indication - AIM-9 missile	
2.3.2.2.1.1	Identify aural indications		Aural tones - AIM-9	AIM-9 audio tone capability	
2.3.2.2.2	Perform boresight lock-on		R.DDI - Boresight display HUD - Steering displays Cage/Uncage Switch (Boresight lock-on)		
2.3.2.2.2.1	Identify aural indications				
2.3.2.3	Verify in-envelope flight				

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.3.2.3.1	Fly steering dot to maintain target		HUD display		
2.3.2.4	Initiate AIM-9 launch		Trigger - on control switch	Targets in air-to-air environment	High
2.3.2.4.1	Sequence to next weapon				
2.3.2.5	Assess weapon effects			Hit, miss distance, missile in range	Medium
2.3.3	PERFORM GUN ATTACK	Sim/Aircraft Airborne; close visual contact with enemy aircraft; gun capable		Visual air-to-air environment with enemy aircraft targets	Low
2.3.3.1	Set up weapon system	Full range of gun options available	Weapon Select Switch HUD - Gun display L.DDI - Stores Format display R.DDI - Radar display		
2.3.3.1.1	Select alternate gun modes		L.DDI - Gun mode options Weapon Select Switch		
2.3.3.1.2	Master Arm Switch to ARM		Master Arm Switch		
2.3.3.2	Track target		Cage/Uncage Switch HUD - Reticle displays, based on mode selection R.DDI - Radar displays (RWS mode)		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
2.3.3.3	Activate gun	Sim/Aircraft configured with 20 mm gun	Trigger on control stick		
2.3.3.4	Assess weapon effects			Hit and/or miss distance	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.0	PERFORM DEFENSIVE TACTICS Reference: A1-F18AC-NFM-100/(C) Supplemental NATOPS	Sim/Aircraft equipped with ECM/ECCM equipment; with/without HARM		AA/AAA/SAM threat environment ALQ-126B Countermeasures Set Functions ALR-67 Radar Warning Receiver Functions ALE-39 Countermeasures Dispensing Set Command Launch Computer Function	High
3.1	SET UP ECM EQUIPMENT	Sim/Aircraft equipped with ALQ-126B Electronic Countermeasures (ECM) set			High
3.1.1	SET UP STAND BY MODE		Dispenser/ECM Control Panel, ECM Mode Knob, Stand-by light		
3.1.2	SET UP RECEIVE MODE		ECM Mode Knob Receive Light Communications Panel		
3.1.3	SET UP REPEAT/TRANSIT MODE		ECM Mode Knob ECM Warning Lights	Threat radar environment	
3.1.4	SET UP RADAR WARNING RECEIVER (RWR)	Sim/Aircraft equipped with ALR-67 RWR equipment	Control Indicator Azimith Indicators	RWR Capability	High
3.1.4.1	Turn on power		Power Button		
3.1.4.2	Check audio volume		Audio Control Headset		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.1.4.3	Check threat warning lights		Warning/Caution Advisory Panel		
3.1.5	SET UP DISPENSER	Sim/Aircraft equipped with ALE-39 Countermeasures dispensing set		ALE-39 dispensing set capabilities	High
3.1.5.1	Select options	Chaff, flare, jammer equipment	Dispenser/ECM Control Panel		
3.1.5.2.1	Select desired decoy		Payload Select Knob		
3.1.5.2.2	Select Mode		Mode Switch		
3.2	COUNTER THREATS	Sim/Aircraft airborne; visual and aural threats received			High
3.2.1	IDENTIFY THREATS VIA COCKPIT VISUAL CUES	Visual AA threat cues received		Visual AA threat environment	
3.2.1.1	Identify bomber threats	Sim/Aircraft Airborne; bomber threat received	DDI - Radar Displays	Visual/Radar air-to-air environment with bomber threats	
3.2.1.2	Identify fighter attack threats	Sim/Aircraft airborne; fighter attack threats received	DDI - Radar Displays	Enemy fighter attack environment	
3.2.1.3	Identify air-to-air missile threats	Sim/Aircraft airborne; incoming A/A missiles threat received	DDI - Radar Displays RWR - Display and aural indications	Enemy A/A missile environment	
3.2.1.4	Identify land based surface-to-air threats	Sim/Aircraft Airborne; AAA/SAM visual cockpit threat received	DDI - Radar Displays RWR - Threat displays, aural indications	AAA/SAM threat environment	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.1.5	Identify naval surface-to-air threats	Sim/Aircraft Airborne; surface ship to air missile threat cues received	DDI - Radar Displays RWR - Threat Displays; aural indications	Surface to air missile environment	
3.2.2	IDENTIFY THREATS VIA AURAL CUES	Sim/Aircraft Airborne; aural AA threat cues	RWR - Threat displays aural tone indications	Aural threat environment	
3.2.2.1	Identify bomber threats	AA aural threats received	DDI - Radar Displays RWR - Aural indications	AA aural threat environment	
3.2.2.2	Identify fighter attack threats	Enemy fighter attack aural cues received	DDI - Radar Displays RWR - Aural indications	Enemy fighter attack environment	
3.2.2.3	Identify air-to-air missile threats	Incoming A/A aural threat cues received	DDI - Radar Displays RWR - Aural indications	Enemy A/A missile environment	
3.2.2.4	Identify land based surface-to-air threats	AAA/SAM aural threat cues received	DDI - Radar Displays RWR - Aural indications	AAA/SAM threat environment	
3.2.2.5	Identify Naval surface-to-air threats	Surface ship to air missile threat cues received	DDI - Radar Displays RWR - Aural indications	Surface to air missile threat environment	
3.2.3	IDENTIFY THREATS VIA EXTERNAL CUES	A/A threats cues received		A/A visual threat environment	
3.2.3.1	Identify bomber threats	Sim/Aircraft airborne; bomber threats sighted		Bomber aircraft in visual environment	
3.2.3.2	Identify fighter attack threats	Sim/Aircraft Airborne; fighter attack threats visually sighted		Fighter attack aircraft in visual environment	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.3.3	Identify air-to-air missile threats	Sim/Aircraft Airborne; A/A missile threats visually sighted		Incoming A/A missiles threat visual environment	
3.2.3.4	Identify land based surface-to-air threats	AAA/SAM threat cures visually received		AAA/SAM visual threat environment	
3.2.3.5	Identify Naval surface-to-air threats	Naval Surface-to-air threats visually received		Naval ship with visual missile threat environment	
3.2.4	RESPOND TO AIR-TO-AIR THREAT	Threat identified target in sight if possible		Air-to-Air missile threat environment	High
3.2.4.1	Select counter tactics	Sim/Aircraft Airborne; visual and aural threats received	DDI - Radar Display RWR - Aural tone threat indications		
3.2.4.2	Counter IR Missile threat	Sim/Aircraft Airborne; equipped with ALQ-126B Electronic Countermeasures equipment; ALE-39 Dispensing Set; ALR-67, RWR equipment		ECM/ECCM capability	
3.2.4.2.1	Perform defensive maneuvers	IR missile threat identified; visual and aural cues received		Air-to-Air visual environment with missile threats	
3.2.4.2.2	Perform ECM	IR missile threat identified; visual and aural cues received; ECM equipment operable	Dispenser/ECM Control Panel RWR Indicator ECM Warning Light	ECM, ECCM capability	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.4.2.2.1	Dispense Chaff/Flares	IR missile threat identified; missile in sight if possible; aircraft equipped with chaff/flares	Dispense/ECM Control Panel Master Arm Switch Flare/Chaff Dispense Switch on Throttle	IR missile environment visual air-to-air environment chaff/ flare capability	
3.2.4.3	Counter radar guided missile threat	Visual and aural threat cues received	Control Indicator Azimith Indicator RWR DDI - Radar Display	Radar guided missile threat environment	High
3.2.4.3.1	Perform defensive maneuvers	Radar guided missile threat identified; visual and aural threat cues received	Dispenser/ECM Control Panel RWR - with aural indicators ECM warning lights	Visual air-to-air environment with missile threats	
3.2.4.3.2	Perform ECM	ECM equipment operable		ECM, ECCM capability	
3.2.4.3.2.1	Dispense Chaff/Flares	Sim/Aircraft equipped with Chaff/Flares	Dispenser/ECM Control Panel Master Arm Switch Flare/Chaff Dispense Switch on throttle	Chaff/Flare capabiltiy	
3.2.4.4	Counter gun threat	Sim/Aircraft Airborne; visual threat cues received; aircraft equipped with 20MM gun		Threat aircraft in air-to-air environment	Medium
3.2.4.4.1	Perform defensive maneuvers	Gun threat identified; visual and aural threat cues received		Visual air-to-air ACM environment	
3.2.4.4.2	Perform ECM	Threat identified; aircraft equipped with ECM equipment	Control Indicator, Azimith Ind RWR DDI - Radar Display	ECM, ECCM Capability	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.4.4.2.1	Dispense Chaff/Flares	Sim/Aircraft equipped with Chaff/Flares	Dispenser/ECM Control Panel Master Arm Switch Flare/Chaff Dispense Switch on throttle	Chaff/Flare capability	
3.2.5	COUNTER AAA THREAT	Sim/Aircraft Airborne; visual and aural threat cues received from land-based and/or shipboard AAA sites		Land-based and/or shipboard AAA threat sites in geographic environment	High
3.2.5.1	Identify AAA threat	Sim/Aircraft Airborne; equipped with ALQ-126B Electronic Countermeasures equipment; ALE-39 Dispensing Set; ALR-67 RWR equipment	DDI - Radar Display RWR - Visual and aural warning indications	ECM/ECCM capability	
3.2.5.1.1	Identify threat via cockpit visual cues	AAA threats received	DDI - Radar Display RWR - Visual AAA indications		
3.2.5.1.2	Identify threat via cockpit aural cues	AAA threats received	RWR - Aural AAA indications Pilot headset		
3.2.5.1.3	Identify threat via external visual cues	AAA threats received		Visual AAA threat environment	
3.2.5.2	Respond to AAA threat	Sim/Aircraft Airborne; visual and aural threat cues received from land based and/or shipboard AAA sites			High
3.2.5.2.1	Select counter tactics				

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.5.2.2	Perform counter to AAA threat	Sim/Aircraft Airborne; AAA threat determined; site/tracer in sight; visual and aural threat cues received from AAA sites.			
3.2.5.2.2.1	Perform defensive maneuvering	Evasive aircraft maneuvers		Visual AAA environment	
3.2.5.2.2.2	Perform ECM	AAA threat received; visual and aural threat cues received; ECM equipment operable	DDI - Radar Display RWR - Visual and Aural threat indications Control Indicator Azimuth Indicator		
3.2.5.2.2.2.1	Dispense Chaff/Flares	Sim/Aircraft equipped with Chaff/Flare equipment	Flare/Chaff Switch on throttle Dispense button on ECM Control Panel. ECM Dispense Button under left Canopy. Dispenser/ ECM Control Panel. Master Arm Switch	AAA Visual enviornment	
3.2.5.2.3	Assess results of counter to AAA threat				
3.2.6	COUNTER SURFACE-TO-AIR MISSILE (SAM) THREATS	Sim/Aircraft Airborne; visual and aural SAM threat cues received		SAM threat environment	High
3.2.6.1	Identify SAM threats	Sim/Aircraft Airborne; equipped with ALQ-126B Electronic Countermeasure equipment; ALE-39 Dispensing Set; ALR-67, RWR equipment	DDI - Radar Display RWR - Visual and Aural indications	ECM/ECCM capability	

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.6.1.1	Identify SAM threat via cockpit visual cues	SAM threats received	DDI - Radar Display RWR - Visual Indications	SAM threat environment	
3.2.6.1.2	Identify SAM threat via cockpit aural cues	Sim/Aircraft Airborne; aural SAM threat cues received	RWR - Aural indications Pilot Headset		
3.2.6.1.3	Identify SAM threat via external visual cues	Sim/Aircraft Airborne; visual SAM threat cues received; SAM threat in sight		Visual SAM threat environment	
3.2.6.2	Respond to SAM threat	Sim/Aircraft Airborne; in threat environment with visual and/or aural SAM threat cues received			
3.2.6.2.1	Select Counter tactics				
3.2.6.2.2	Perform Counter to SAM threat	Sim/Aircraft Airborne; SAM threat in sight or direction/proximity identified by visual and aural SAM threat cues.	DDI - Radar Display RWR - Visual and aural indications	Visual SAM threat environment	
3.2.6.2.2.1	Perform aircraft maneuvering	Evasive aircraft maneuvers			
3.2.6.2.2.2	Perform ECM	SAM threat identified; visual and aural cues received; ECM equipment operable	DDI - Radar Display RWR - Visual and aural indications Control Indicator Azimuth Indicator		
3.2.6.2.2.2.1	Dispense Chaff/Flares	Sim/Aircraft Airborne; equipped with Chaff/Flare equipment	Flare/Chaff Switch on throttle Dispenser/ECM Control Panel Master Arm Switch		

NUMBER	TASK	CONDITIONS	CONTROLS/DISPLAYS/INDICATORS	SIMULATION REQUIREMENTS	PRIORITY
3.2.6.2.2.3	Perform HARM delivery	Sim/Aircraft Airborne; equipped with operational HARM missiles	DDI - HARM display HUD - HARM display	SAM site environment	High
3.2.6.2.2.3.1	Perform Self Protect/Pullback HARM delivery See task: 1.5.8				
3.2.6.2.2.4	Assess results of counter to SAM threat				